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**REMEDIAL DESIGN  
WORK PLAN TO CAP THE  
CINDER/SLAG FILL AREA LOCATED ON  
LIBERTY PROPERTY TRUST'S  
2301 RENAISSANCE BOULEVARD PROPERTY**

Prepared For:

**United States Environmental Protection Agency**

and

**Pennsylvania Department of Environmental Protection**

On behalf of:

**Liberty Property Trust**  
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Great Valley Corporate Center  
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April 23, 2001  
4013-01000



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## 1.0 BACKGROUND INFORMATION

As part of Liberty Property Trust's (Liberty's) due diligence survey, an area of fill material was identified in the northwest portion of their 2301 Renaissance Boulevard property. The approximate location of this fill area is shown on Figure 1. As part of the investigation of this material, over ten test trenches were installed into this area. Based on information obtained from the test trenches, the material in this area consists primarily of glass, ash, cinders, and slag. The surface expression of the fill encompasses an area, on average, about 150 feet long by 200 feet wide and the fill is up to 10 feet thick. There is approximately 3,000 cubic yards of fill located in this area. The source of the fill is not known, however, based on historical aerial photographs, it was placed in this area prior to 1959.

To evaluate the chemical makeup of the fill, Penn E&R collected a grab soil sample from one of the test trenches. This sample, which was designated FT-3, was collected from material that appeared to be most representative of the fill and from an area where elevated PID readings were detected. The sample was analyzed for the TCL volatile and semivolatile organic compounds and the TAL inorganics (i.e., metals and cyanide).

The results of the analysis of this sample are summarized in Table 1. In evaluating the fill sample results, the data were compared to Act 2 non-residential soil-to-groundwater MSCs and USEPA generic soil-screening-levels (SSLs). A review of Table 1 shows that no volatile or semivolatile organic compounds are present in the fill above Act 2 MSCs or USEPA SSLs. With the exception of arsenic and lead, no metals are present in the fill above Act 2 non-residential soil-to-groundwater MSCs or USEPA generic SSLs. Arsenic was detected above its very restrictive USEPA generic SSL of 0.026 mg/kg but not above its Act 2 non-residential soil-to-groundwater MSC. Lead was detected above both its Act 2 MSC and USEPA generic SSL.

The Record of Decision for the Crater Resources Superfund Site selected capping as the appropriate remedy for Quarries 1, 2 and 4 and other contaminated soil areas. In discussions between EPA and Penn E&R, EPA has indicated that it considers the cinder/slag fill area to be a contaminated soil area related to the Crater Resources Site. Therefore, Penn E&R has prepared this Remedial Design Work Plan to be consistent with the remedy selected for the Site.

## **2.0 CAP DESIGN**

### **2.1 Technical Specifications**

In accordance with the Crater Resources Superfund Site Record of Decision, a multi-media cap consisting of low-permeability clays, geotextile liners, sand drainage layers and soil or other appropriate covers are to be installed over Quarries 1, 2 and 4 and other contaminated soil areas. The cap is to be consistent with the Commonwealth of Pennsylvania's Residual Waste Regulations for the final cover of Class 1 residual waste landfills. Penn E&R has designed a multi-media cap for the cinder/slag fill area to meet these requirements. Individual tasks to be completed as part of the remedial action are provided below.

#### **2.1.1 Task 1 - Determination of the Exact Size and Location of the Cap**

Because the actual dimensions and location of the cap will be developed as part of the implementation of the remedial action, detailed drawings of the cap have not yet been developed. Such drawings will be developed and included in the Remedial Action Completion Report. However, Figure 1 shows the approximate size and location of the area to be capped. Figure 1 also indicates how the cap will be incorporated into LPT's redevelopment of the site as part of its construction of the office building and parking area on the 2301 property.

As part of the Task 1 activities, Penn E&R will mobilize a backhoe to the site to install test trenches around the perimeter of the cinder/slag fill area. As shown on Figure 1, the limits of the cinder/slag fill area were delineated as part of previous on-site investigations. Therefore, the results of the Task 1 activities will be used to confirm these limits and delineate the area to be included under the Cap.

Penn E&R currently envisions installing from ten to fifteen test trenches around the perimeter of the cinder/slag fill area. The initial test trenches will be located outside but within five feet of the expected extent of the cinder/slag fill area. The soil at each test trench location will be excavated and placed directly onto plastic sheeting. The test trenches will be excavated to a depth of at least five feet below the ground surface (BGS). The excavated soils will be visually inspected for evidence of fill. If fill is encountered, excavation at that location will be stopped and another test trench will be installed five feet further out from the trench in which fill was visually observed. This process will be continued until the limits of the cinder/slag fill area have been delineated. After the limits of the area have been delineated, the limits of the slag/fill area will be flagged. The exact boundaries of the cinder/slag fill area will then be surveyed and located on a scaled site map. This scaled map will be provided to the capping contractor for use in installation of the cap. Surveyed locations will be accurate within 0.05 feet on a horizontal basis and 0.01 feet on a vertical basis.

Since the approximate limits of the cinder/slag fill area have already been determined, it will not be necessary to have any equipment on top of the fill material. In the event fill is encountered during the installation of any of the test trenches, it will be placed directly back into the trench in which it was observed. The bucket of the backhoe will then be cleaned with soap and water before moving to the next test trench location. The wash water generated during this process

will be containerized in a 55-gallon drum. The contents of the drum will be characterized and then shipped off-site for disposal at a properly permitted facility. As indicated above, the backhoe will not be placed on top of the exposed fill. Therefore, it will not be necessary to decontaminate the wheel/tracks prior to it leaving the site. Penn E&R will ensure that no mud/dirt is tracked off-site.

### **2.1.2 Task 2 - Preparation of the Area to be Capped**

At the conclusion of Task 1 activities, the cinder/slag fill area will be prepared for cap installation. Prior to the preparation of the cinder/slag fill area, Penn E&R will construct a temporary decontamination pad. All vehicles that are used to prepare or that could possibly come in direct contact with the materials in the cinder/slag fill area will be decontaminated on the pad prior to leaving the area or the site. The pad will be constructed of a sufficient thickness of PVC and will be covered with 2A-modified stone or rip-rap. The pad will be constructed in such a way that water will drain to a sump installed at one end of the pad. Any wash water that collects in the sump will be pumped into 55-gallon drums or a temporary aboveground tank for later disposal at an off-site properly permitted facility. The pad will be covered with plastic when not in use so that rainwater does not collect in the sump.

Upon completion of the installation of the decontamination pad, miscellaneous debris that is now present on the surface of the area will be removed and staged to an on-site area for later off-site disposal. The removed materials will be placed on and covered with plastic to eliminate runoff and run on while awaiting disposal. Miscellaneous debris consists mainly of wood, tree stumps, tires and other debris which could compromise the integrity of the cap. All vegetation and tree stumps which could degrade will be removed. In addition, all materials larger than 6-inches will be removed from the surface of the area for off-site disposal.

The cinder/slag fill area will then be graded. Any additional debris uncovered during the grading will be removed and placed with material previously collected. Penn E&R will conduct the grading. Care will be taken to avoid disturbing the flags placed during the Task 1 activities.

Grading activities will be conducted to ensure that visible dust is not created. If it is excessively dry, the cinder/slag material will be wetted as needed to prevent visible dust. Equipment used in the grading process will be properly decontaminated after the grading is completed.

For the final preparation of the area, a 3-inch thick base of sand will then be placed over the newly graded cinder/slag fill area. The sand base will provide a suitable foundation for the cap and will serve to eliminate direct contact with the materials by employees of the cap installation contractor. The sand will be placed such that its aerial extent covers the entire cinder/slag fill area and provides for a two-foot buffer zone around the circumference of the fill area.

### **2.1.3 Task 3 - Installation of the Cap**

Upon completion of the Task 1 activities, Penn E&R will supply the results of the investigation to Environmental Geosynthetics, Inc. (EGI), the subcontractor that will install the cap. Penn E&R will provide EGI with scaled site plans that show the location of the area to be capped.

including the 2-foot buffer. Copies of the scaled site plans will also be provided to representatives of EPA and PADEP and LPT's construction contractors.

A cross-section of the proposed cap is presented as Figure 2. As indicated on Figure 2, the cap will consist of a 40-mil PVC liner (Liner), a drainage layer consisting of a 12-ounce geotextile membrane (Drainage Layer) and a layer of soil, at least two feet thick (Uniform Soil Layer). After placement of the cover, LPT's development plans for the area call for the area to be covered with an asphalt parking lot.

The PVC liner will be installed by EGI. Information on the qualifications and experience of this contractor is provided in Appendix A. As you will note, this contractor is experienced in the installation of PVC liners at landfills, wastewater treatment ponds, lagoons and basins. Many of the landfill covers were constructed at locations within USEPA Region 3 and Pennsylvania. Two notable landfills include the O'Hara landfill in King of Prussia where EGI installed a 226,000 square foot PVC cap and the Revere Superfund site in Revere, PA where EGI installed a 377,000 square foot 40-mil PVC cap.

The Liner will be obtained from the Watersaver Company, Inc. (WCI). As indicated in a letter provided by WCI (see Appendix A), EGI is an Watersaver-approved installer of their 40-mil PVC liners. EGI will install the Liner in accordance with the WCI document entitled "Manufacture, Fabrication and Installation of Polyvinyl Chloride Geomembranes," dated June 1993. A copy of this installation manual is included in Appendix B. As you will note the manual sets standards for the manufacture, fabrication and installation of PVC geomembrane liners. The installation, quality control and seam testing procedures described in the manual will be strictly followed. A specification sheet for the PVC liner is also provided in Appendix B.

EGI will air lance test all of the liner seams following the procedures specified in the aforementioned manual. Also, EGI will take two destructive tests at random from the liner for testing by an outside laboratory.

The 12-ounce geotextile membrane drainage layer will also be installed by EGI. This membrane will be placed directly over the Liner and will promote drainage away from the capped area. The geotextile membrane will be obtained from TNS Advanced Technologies (TNS) and will be installed by EGI following the procedures outlined in the TNS Installation Guideline provided in Appendix C. A specification sheet for the geotextile membrane along with the Quality Control program TNS follows in manufacturing the membrane is included in Appendix C. As noted on the specification sheet, the membrane is composed of polypropylene fibers. EGI will use heat seaming methods to joint the sections of the geotextile membrane.

Soil comprising the Uniform Soil Layer will be placed directly over the Drainage Layer. This soil will be obtained from grading activities at the remainder of the 2301 construction site or will be brought in from off-site sources. Penn E&R will be responsible for documenting that the soil complies with the requirements for the Uniform Soil Layer by completing appropriate geotechnical testing (i.e., sieve analysis) on the soil prior to its use. Penn E&R plans to perform about one sieve analysis per 1,000-cubic yards of soil used to form the Uniform Soil Layer. The Uniform Soil Layer will be installed by Allan A. Myers.

The soils used to form the Uniform Soil Layer will be placed to ensure that the underlying geotextile membrane and liner are not disturbed. This will be completed by starting to place the soils from the edge of the capped area and working in towards the center of the cap. This will ensure that the equipment used to install the Uniform Soil Layer is always working on top of a sufficient thickness of soil so that the underlying Drainage Layer and Liner are not disturbed.

As shown on Figure 1, the final grading of the area will ensure the placement of at least two feet of the Uniform Soil Layer over the entire cinder/slag fill area. As indicated on the figure, final grades will comply with residual waste requirements. As discussed below and as indicated on the figure, no vegetative cover will be required for the area because LPT's development plans will provide for an asphalt parking lot to be constructed over the entire cinder/slag fill area.

## **2.2 Compliance with ARARs**

As discussed below, the design of the Cap as laid out above meets the requirements of 25 Pa. Code Sections 288.234 and 288.236-237 and is consistent with the requirements of the Record of Decision (ROD) developed for the Crater site.

### **Section 288.234 (a) (1)**

The installation of the 40-mil liner conforms to the performance and design standards of this Subsection. That is, the permeability of the 40-mil liner is less than  $1.0 \times 10^{-7}$  cm/sec and the 40-mil liner will:

- (i) Minimize the migration of precipitation into the fill material;
- (ii) Be resistant to physical and chemical failure; and
- (iii) Cover all areas of the fill material

### **Section 288.234 (a) (2)**

This Subsection requires the installation of a Drainage Layer over the Cap to transmit flow and prevent erosion of the soil layer. The 12-ounce geotextile membrane to be installed on top of the liner will transmit flow and will help prevent erosion of the Uniform Soil Layer as it will allow water to flow off of the Cap. Further, the asphalt parking lot to be placed over the Uniform Soil layer and the Drainage Layer will also serve to minimize the amount of water which can infiltrate into this area.

### **Section 288.234 (a) (3)**

This Subsection requires the installation of a Uniform Soil Layer over the Cap to support vegetation and protect the Cap. The Drainage Layer will be covered by at least 2 feet of soil and then an asphalt parking lot, which will further protect the Cap. Revegetation of the capped area will not be required because the asphalt parking lot will prevent erosion of the Cap without it having to be vegetated.

**Section 288.234 (b)**

A waiver of the Cap and Drainage Layer requirements is not being requested for the cinder/slag area.

**Section 288.234 (c)**

As required by this Subsection, the 40-mil PVC liner to be used to cap the cinder/slag area actually exceeds the minimum design requirements set forth for caps in Appendix A, Table II, which calls for a geosynthetic liner of at least 30 mil thickness.

**Section 288.234 (d)**

This Subsection of the regulations does not apply to the cinder/slag fill area since it pertains to the timing for placement of final cover over a landfill. LPT intends to complete the capping set forth herein in accordance with the schedule provided in Section 5.0.

**Section 288.234 (e)**

As required by this subsection, the Uniform Soil Layer will:

- (1) prevent vectors, odors, blowing litter, and other nuisances;
- (2) cover the fill material without change to its properties and without regard to weather;
- (3) be capable of allowing loaded vehicles to successfully maneuver over it after placement;
- (4) be capable of controlling fires;
- (5) be capable of preventing frost damage to the cap;
- (7) not crack excessively when dry.

The Uniform Soil Layer will be covered by an asphalt parking lot. As such, it will not be able to support the germination and propagation of vegetative cover as required by Subsection (e)(6), however the asphalt parking lot will serve the same purpose as the vegetative cover, which is to prevent erosion of the Uniform Soil Layer below. Accordingly, the purpose of this requirement is satisfied by the asphalt parking lot and a vegetative cover is unnecessary. Also, Subsection (e)(8) does not apply to the cinder/slag fill area as a waste acceptance plan was not required or developed for this area.

**Section 288.234 (f)**

As required by this subsection, the Uniform Soil Layer will meet the following requirements:

- (1) fall within the United States Department of Agriculture textural classes of sandy loam, loam, sandy clay loam, silty clay loam, loamy sand and silt loam as defined in the Soil Survey Manual;



- (2) at least 40 percent by weight will be capable of passing through a 2 millimeter, No. 10 mesh sieve;
- (3) not include rocks that are greater than 6-inches in diameter; and
- (4) be at least 2 feet thick.

#### **Section 288.234 (g)**

As required by this subsection, the grade of the asphalt parking lot to be installed on top of the Uniform Soil Layer will be designed, installed and maintained to:

- (1) ensure permanent stability;
- (2) control erosion due to rapid water velocity and other factors;
- (4) ensure minimal infiltration and percolation of precipitation, surface water run-on and run-off into the cinder/slag fill area.

Subsection (g)(3) requires that the Uniform Soil Layer allow compaction, seeding and revegetation of cover material placed on slopes. Revegetation of this area will not be required because the asphalt parking lot will prevent erosion without having to be vegetated.

#### **Section 288.234 (h)**

As required by this subsection, the asphalt parking lot to be installed on top of the Uniform Soil Layer will be designed, installed and maintained to:

- (1) have a grade of at least 3 percent and no more than 15 percent.

Since the final grade of the asphalt parking lot will be less than 15 percent, Subsections (2) (i-iii) and (3) do not apply.

#### **Section 288.236 (a-f)**

This Section requires revegetation of the Uniform Soil Layer placed over the Cap. The revegetation in this Section is required to prevent erosion of the Uniform Soil Layer and to protect the Cap. The asphalt parking lot to be installed on top of the Uniform Soil Layer will prevent erosion and does not have to be revegetated to ensure that erosion does not occur. Therefore, the installation of the asphalt parking lot will satisfy the intent of this Section.

#### **Section 288.237 (a&b)**

This Section outlines the requirements to ensure the successful revegetation of the Uniform Soil Layer. As indicated above, the asphalt parking lot to be installed on top of the Uniform Soil Layer will prevent erosion and does not have to be revegetated to ensure that erosion does not occur. Therefore, the installation of the asphalt parking lot will satisfy the intent of this Section.

### **3.0 REMEDIAL ACTION COMPLETION REPORT**

Upon completion of the installation of the cap, Penn E&R will develop and submit to the EPA and PADEP a Remedial Action Completion Report. This report will provide a detailed discussion of the activities that were completed as part of the installation activities and an as-built drawing that shows the exact surveyed location of the cinder/slag fill area. Scaled cross-sections will also be included in the report, which will detail the materials used to construct the cap and the design of the cap. The contractor's involved in the installation of the cap will be included in the report.

Penn E&R will document the entire cap installation process with photographs. A copy of these photographs will be included in the Remedial Action Completion Report. Also, deed acknowledgment language to identify the presence and location of the cap and restrictions on the future use of the capped area will also be included in the report.

#### **4.0 HEALTH AND SAFETY PLAN**

As discussed in Section 1.0, the primary contaminant of concern in the fill material in the cinder/slag area is lead. This was also the primary contaminant of concern detected in Quarry No. 4. The maximum concentration at which lead was detected in the cinder/slag fill area was similar to the maximum concentration detected in Quarry No. 4 (i.e., just above 2,000 mg/kg). Penn E&R previously developed a Site-Specific Health and Safety Plan (SSHSP) for intrusive work completed/planned to be completed in Quarry No. 4. Since the contaminants of concern in Quarry No. 4 are similar to those in the cinder/slag fill area, all work in the cinder/slag fill area will be completed following the procedures and guidelines included in the aforementioned SSHSP. A copy of the SSHSP is included in Appendix D.

## **5.0 SCHEDULE OF IMPLEMENTATION**

As you are aware, LPT is currently in the process of developing the 2301 property. In order to meet LPT's construction schedule, the installation of the cover for the slag/fill area will be performed in accordance with the schedule below. LPT has already modified its existing construction plans such that the development work in the cinder/slag fill area will occur at the latest date possible. The schedule below will be implemented to avoid any additional construction delays.

Week of April 23, 2001 - Implementation of the Task 1 activities

Week of May 21, 2001 - Installation of the Cap

Week of June 25, 2001 - Submittal of the Remedial Action Completion Report

As discussed above, we believe that LPT's proposed Cap for the cinder/slag fill area meets the requirements of the ROD and the Commonwealth of Pennsylvania's Residual Waste Management Regulations for final cover of Class 1 residual waste landfills as set forth in 25 Pa. Code Sections 288.234 and 288.236-237, the regulations cited in the ROD. Therefore, we would appreciate EPA's and PADEP's expedited review and approval of this design so that we can initiate the activities on this project in accordance with the project schedule provided above.

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**Figures**

EPA REGION III  
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

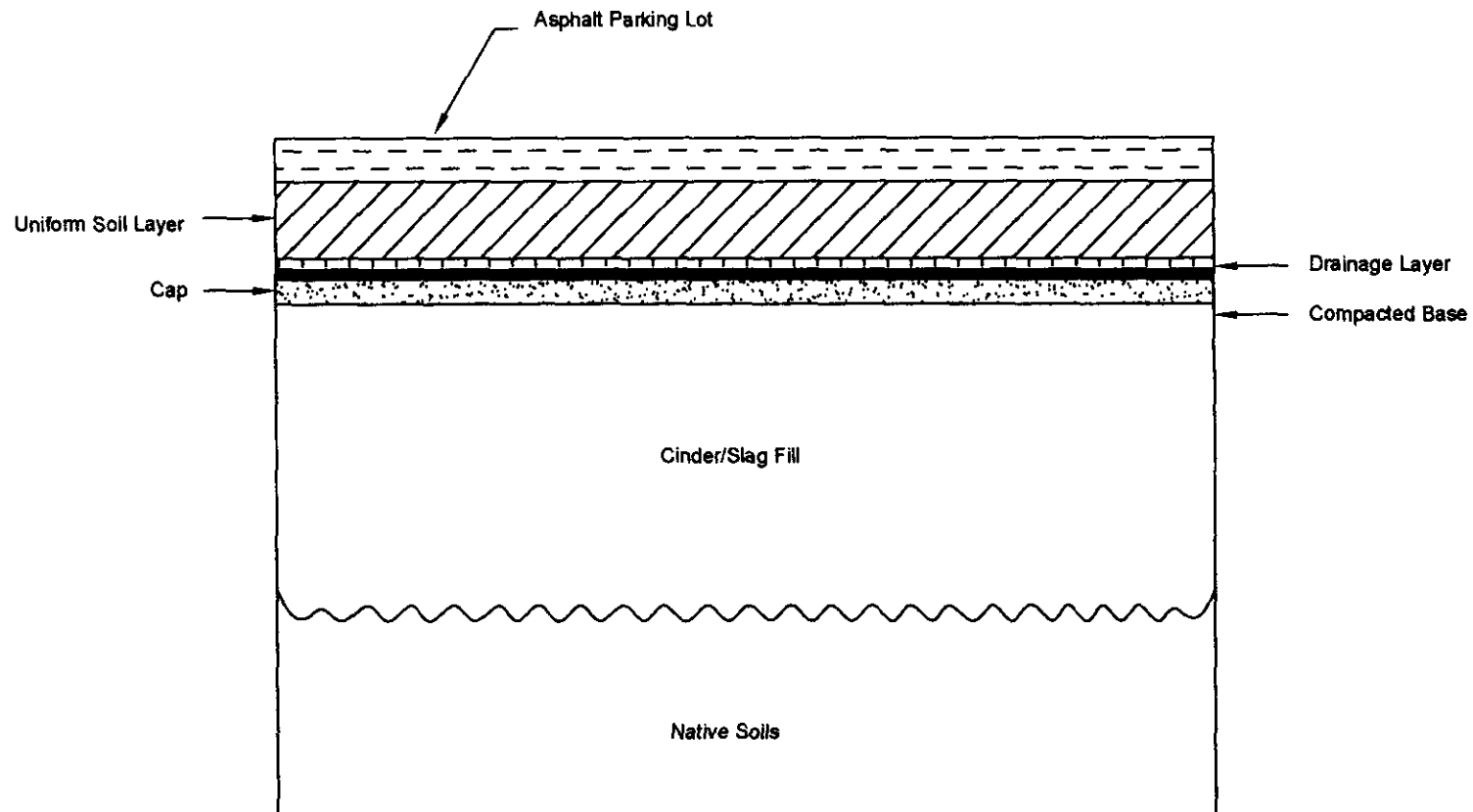
DOC ID # 357127  
PAGE # \_\_\_\_\_

IMAGERY COVER SHEET  
UNSCANNABLE ITEM





Contact the CERCLA Records Center to view this document.

SITE NAME	<u>Crater Resources</u>
OPERABLE UNIT	<u>00</u>
SECTION/BOX/FOLDER	<u>Sa- 4- 5.010</u>

REPORT OR DOCUMENT TITLE	<u>Remedial Design (RD)</u> <u>Work Plan To Cap Fill Area</u>
DATE OF DOCUMENT	<u>April 23, 2001</u>
DESCRIPTION OF IMAGERY	<u>Figure 1- Site Layout</u> <u>Map</u>
NUMBER AND TYPE OF IMAGERY ITEM(S)	<u>1 oversized map</u>



## LEGEND

-  Uniform Soil Layer - At 2 Feet Thick
-  Drainage Layer - 12 Ounce Geotextile Membrane
-  Cap - 40 Mil PVC
-  Compacted Base - 3 Inch Thick Layer of Sand

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BY: DMA

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DATE

12-Apr-01

PENN E&R DRAWING NO.

4013-007-01000

FIGURE NO.

REV.

FIGURE 2

Cross-Section of Proposed  
Cap to be Installed  
Over the Cinder/Slag Fill Area  
2301 Renaissance Boulevard  
Upper Merion Township, Montgomery County, PA

DATE

12-Apr-01

GRAPHIC SCALE

2

FRACTIONAL

1

0

1

DECIMAL

2

/



TABLE 1

**SUMMARY OF ANALYTICAL RESULTS FOR THE SAMPLE  
COLLECTED FROM THE SLAG/CINDER FILL AREA**

ANALYTICAL PARAMETERS	SAMPLE DESIGNATION/ ANALYTICAL RESULTS <sup>(1)</sup>	PADEP NSRG MSC <sup>(2)</sup>	USEPA SG SSL <sup>(3)</sup>
	FT-3		
<b><i>Volatile Organics<sup>(4)</sup>:</i></b>			
Methylene Chloride	0.012JB	0.5	0.019
<b><i>Semivolatile Organics<sup>(4)</sup>:</i></b>			
Acenaphthylene	<0.44	4,400	NSA
Anthracene	<0.44	230	470
Benzo(a)anthracene	0.25J	320	1.5
Benzo(b)fluoranthene	0.34J	160	4.5
Benzo(k)fluoranthene	0.079J	600	4.5
Benzo(g,h,i)perylene	0.24JB	180	NSA
Benzo(a)pyrene	0.24JB	46	0.37
Bis(2-ethylhexyl)phthalate	0.39J	130	2,900
Carbazole	<0.44	NSA	NSA
Chrysene	0.27J	220	150
Dibenzo(a,h)anthracene	0.074J	160	1.4
Fluoranthene	0.34J	3,300	6,300
Fluorene	<0.44	380	140
Indeno(1,2,3-cd)pyrene	0.21J	28,000	22
Naphthalene	<0.44	10	0.15
Phenanthrene	0.13J	11,000	NSA
Pyrene	0.31J	220	680
<b><i>Inorganics<sup>(4)</sup>:</i></b>			
Aluminum	13800	NSA	NSA
Antimony	7.4C	27	13
Arsenic	<b>19.8</b>	150	0.026
Barium	996	8,200	2,100
Beryllium	0.54C	320	1,200
Cadmium	8.2	38	27
Calcium	29400	NSA	NSA
Chromium	67.5	190,000	2x10 <sup>9</sup>
Cobalt	16.4	610	NSA
Copper	401	36,000	11,000
Iron	75900	NSA	NSA
Lead	<b>2390</b>	450	NSA
Magnesium	4690	NSA	NSA
Manganese	744	NSA	950
Mercury	0.25	10	NSA
Nickel	92.0	650	NSA
Potassium	2100	NSA	NSA
Selenium	<0.72	26	19
Silver	3.1	84	31
Sodium	<52.5	NSA	NSA
Thallium	0.78C	14	3.6

TABLE 1 - CONTINUED

**SUMMARY OF ANALYTICAL RESULTS FOR THE SAMPLE  
COLLECTED FROM THE SLAG/CINDER FILL AREA**

ANALYTICAL PARAMETERS	SAMPLE DESIGNATION/ ANALYTICAL RESULTS <sup>(1)</sup>	PADEP NSRG MSC <sup>(2)</sup>	USEPA SG SSL <sup>(3)</sup>
	FT-3		
Vanadium	28.0	71,508 <sup>(5)</sup>	5,100
Zinc	5620	12,000	14,000
Cyanide	<1.33	200	150

Notes:

- (1) - All results are in milligrams per kilogram
- (2) - Pennsylvania Department of Environmental Protection, Land Recycling and Environmental Remediation Standards Act (Act 2), Non-Residential Used Aquifer Soil-to-Ground Water Medium Specific Concentration (August 1997)
- (3) - United States Environmental Protection Agency, Region III, RBC Table, Soil-to-Ground Water Soil Screening Levels, DAF-20 (April 2000)
- (4) - Only those volatile or semivolatile organic compounds which were detected above the method limit are shown
- (5) - The current MSC developed for vanadium was incorrectly calculated. The PADEP is aware of this error. The MSC listed for vanadium was calculated using the correct toxicological data.
- PADEP - Pennsylvania Department of Environmental Protection
- NRSG - Non-Residential Soil-to-Ground Water
- MSC - Medium Specific Concentration
- USEPA - United States Environmental Protection Agency
- SG - Soil-to-Ground Water
- SSL - Soil Screening Level
- J - Compound was detected below the method detection limit and the reported concentration should be considered an estimate.
- B - This result is qualitatively invalid because the compound/analyte was also detected in a blank at a similar concentration.
- C - The result is between the estimated quantitation limit and the instrument detection limit
- <0.44 - Compound was not detected above the listed method detection limit
- NSA - No Standard Available
- Bold** - Indicates compound was detected above either its PADEP MSC or USEPA SSL

*APPENDIX A*

**SUMMARY OF LINER EXPERIENCE FOR  
ENVIRONMENTAL GEOSYNTHETICS, INC.  
AND WATERSAVER'S INSTALLATION CERTIFICATION LETTER**

**ENVIRONMENTAL GEOSYNTHETICS, INC.**  
**1991-2000 Completed Liner Installations (partial listing)**

Owner - Ohio Valley Coal  
Location - Coal handling facility  
Powhattan Point, Ohio  
Descrip. - groundwater protection  
Area - 131,000 sq. ft.  
Type - 30 mil PVC  
Date - Jan. 91  
Seamer - R. Halbom

Owner - PADOT  
Location - Southern Expressway  
Pittsburgh, PA  
Descrip. - Wetland protection  
Area - 15,000 sq. ft.  
Type - 40 mil HDPE  
Date - Feb. 91, July 91  
Seamer - R. Halbom

Owner - American Cyanamid  
Location - Clarksville Rd  
Heightstown, N.J.  
Descrip. - Fire pond - emergency chemical containment  
Area - 13,405 sq. ft.  
Type - 30 mil PVC  
Date - April 91  
Seamer - R. Halbom

Owner - GTE Products Corporation  
Location - Hawes St.,  
Towanda, PA  
Descrip. - Secondary containment - acid neutral. tank  
Area - 15,000 sq. ft.  
Type - 60 mil HDPE  
Date - June 91  
Seamer - R. Halbom

Owner - Gehl Corporation  
Location - RT. 419  
Cornwall, PA  
Descrip. - Fire pond  
Area - 87,000 sq. ft.  
Type - 20 mil PVC  
Date - June 91  
Seamer - R. Halbom

Owner - Lynchwood Lake Dam (church owned camp)  
Location - Rt. 611  
Mt. Pocono, PA  
Descrip. - Spillway  
Area - 1,000 sq. ft.  
Type - 45 mil Hypalon  
Date - May 91  
Seamer - R. Halbom

Owner - Solanco School District  
Location - Quarryville, PA  
Descrip. - (3) waste treatment detention lagoons  
Area - 5000 sq. ft.  
Type - 40 mil PVC  
Date - August 91  
Seamer - M Ramsden  
QA - R. Halbom

Owner - American Sweetener  
Location - Malvern, PA  
Descrip. - Detention pond  
Area - 10,500 sq. ft.  
Type - 30 mil PVC  
Date - August 91  
Seamer - R. Halbom

Owner - Phil Waters  
Location - Legonaire, PA  
Descrip. - Potable water cistern  
Area - 1000 sq. ft.  
Type - 36 mil 8128 vinyl w/scrim  
Date - September 91  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - White Tail Golf Course  
Location - Bath, PA  
Descrip. - Golf course pond  
Area - 18,000 sq. ft.  
Type - 30 mil PVC  
Date - September 91  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Wyeth Labs  
Location - Westchester, PA  
Descrip. - Underground drainage effluent containment  
Area - 1500 sq. ft.  
Type - 30 mil PVC  
Date - October 91  
Seamer - M. Ramsden

Owner - Robert Purdom  
Location - Stockton, N.J.  
Descrip. - Pond Area - 17,000 sq. ft.  
Type - 20 mil FG PVC  
Date - October 91  
Seamer - R. Halbom

Owner - Whitetail Golf Course  
Location - Bath, PA  
Descrip. - Pond  
Area - 100,000 sq. ft.  
Type - 30 mil PVC  
Date - October 91  
Seamer - R. Halbom

Owner - Cherry Hill Township  
Location - Cherry Hill, N.J.  
Descrip. - Detention pond  
Area - 35,000 sq. ft.  
Type - 40 mil HDPE, 60 mil Textured HDPE  
Date - December 91  
Seamer - M Ramsden  
QA - R Halbom

Owner - Greater Lebanon Refuse Authority  
Location - Lebanon, PA  
Descrip. - Secondary Containment and Tank Underliner  
Area - 1500 sq. ft.  
Type - 60 mil HDPE  
Date - January 1992  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - SMC Corporation  
Location - Upper Merion Twp. PA  
Descrip. - Water Detention Basin  
Area - 5000 sq. ft.  
Type - 40mil HDPE  
Date - February 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - O'Hara  
Location - King of Prussia, PA  
Descrip. - Landfill cap  
Area - 226,000 sq. ft.  
Type - 40 mil HDPE  
Date - April, May 1993  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Edward Armstrong & Sons, Inc.  
Location - Lancaster, PA  
Descrip. - Septage Treatment tank  
Area - 2000 sq. ft.  
Type - 36 mil Hypalon  
Date - March 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Lower Paxton Township  
Location - Lower Paxton Twp. Landfill  
Descrip. - Geonet/Geotextile underliner system  
Area - 2000 sq. ft.  
Type - PN 3000, 4510  
Date - Feb. 1992  
QA - R. Halbom

Owner - Borough of Fleetwood  
Location - Ruscombmanor Twp., PA  
Descrip. - Potable water tank liner  
Area - 6500 sq. ft.  
Type - 36 mil Hypalon  
Date - April 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - LOU Technical Steering Committee  
Location - King of Prussia, PA  
Descrip. - Water Main Isolation  
Area - 35,000 sq. ft.  
Type - 30 mil PVC  
Date - April 1992  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - LOU Technical Steering Committee  
Location - King of Prussia, PA  
Descrip. - Landfill cap  
Area - 200,000 sq. ft.  
Type - Geotextile  
Date - June 1992  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Glasbern, Inc.  
Location - Fogelsville, PA  
Descrip. - Pond  
Area - 16,000 sq. ft.  
Type - 20 mil fish grade PVC  
Date - May 1992  
Seamer - R. Halbom

Owner - United Church of Christ  
Location - Wayne, PA  
Descrip. - Detention Basin  
Area - 5000 sq. ft.  
Type - 30 mil PVC  
Date - July 1992  
Seamer - R. Halbom



Owner - A.C.U.A.  
Location - Haneman Environmental Park, N.J.  
Descrip. - Landfill Cell  
Area - 795,000 sq. ft.  
Type - 60 mil HDPE / Geonet  
Date - July, August, September 1992

Owner - A.C.U.A.  
Location - Haneman Environmental Park, N.J.  
Descrip. - Landfill Cell, road, Waste treatment stabil.  
Area - 1,200,000 sq. ft.  
Type - 16 oz. geotextile, 4 oz. geotextile  
Date - June, July, August, September 1992  
QA - R. Halbom

Owner - Robeson-Wernersville Municipal Authority  
Location - Wernersville, PA  
Descrip. - WWTP Reed beds  
Area - 21,560 sq. ft.  
Type - 40 mil PVC  
Date - September 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Mahanoy City Municipal Authority  
Location - Mahanoy, PA  
Descrip. - Sludge drying beds  
Area - 52,920 sq. ft.  
Type - 40 mil PVC  
Date - September 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - South Middleton Twp. Municipal Authority  
Location - Boiling Springs, PA  
Descrip. - WWTP Reed beds  
Area - 58,800 sq. ft.  
Type - 20 mil PVC  
Date - October 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Rohm & Haas  
Location - Croydon, PA  
Descrip. - Secondary trench containment  
Area - 2000 sq. ft.  
Type - 60 mil HDPE, Geonet, Geotextile  
Date - October 1992  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Private Estate  
Location - Buckingham, PA  
Descrip. - Pond Area - 17,570 sq. ft.  
Type - 20 mil PVC (fish grade)  
Date - November 1992  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - GATX  
Location - Paulsboro, N.J.  
Descrip. - Oil storage tank farm - secondary cont.  
Area - 160,000 sq. ft.  
Type - Bentomat  
Date - November, December 1992  
QA - M. Ramsden

Owner - Kline's Septic Service  
Location - Lancaster, PA  
Descrip. - Septage storage tanks  
Area - 8,750 sq. ft.  
Type - 40 mil PVC  
Date - April 1993  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - White Tail Golf Club  
Location - Bath, PA  
Descrip. - Golf course pond  
Area - 40,000 sq. ft.  
Type - 30 mil PVC  
Date - April 1993  
Seamer - R. Halbom

Owner - PA Fish & Boat Commission  
Location - Pleasant Mt. Fish Culture Station  
Descrip. - Fish Hatchery  
Area - 4,000 sq. ft.  
Type - 36 mil Hypalon  
Date - May 1993  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Charles Sheppard  
Location - Plymouth Meeting, PA  
Descrip. - Detention pond  
Area - 15,000 sq. ft.  
Type - 20 mil PVC  
Date - June 1993  
Seamer - M. Ramsden

Owner - Spring Mill Country Club  
Location - Ivyland, PA  
Descrip. - Golf course pond  
Area - 8,000 sq. ft.  
Type - 30 mil PVC  
Date - June 1993  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - American Cyanamid  
Location - Princeton, N.J.  
Descrip. - Secondary containment lagoon  
Area - 1,000 sq ft  
Type - 30 mil PVC  
Date - June 1993  
Seamer - R. Halbom

Owner - City of Bethlehem  
Location - Bethlehem, PA  
Descrip. - Water tank ringwall liner system  
Area - 25,000 sq. ft.  
Type - 30 mil MDPE  
Date - July 1993  
QA - M. Ramsden

Owner - Richmond School District  
Location - Richmond, PA  
Descrip. - (2) Detention ponds  
Area - 50,000 sq. ft.  
Type - 20 mil PVC  
Date - August 1993  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - TDE Landscaping  
Location - Lower Saucon Twp. , PA  
Descrip. - Pond  
Area - 19,000 sq. ft.  
Type - 20 mil PVC  
Date - September 1993  
Seamer - R. Halbom

Owner - Dorney Park  
Location - Dorneyville, PA  
Descrip. - Equalization tank secondary containment  
Area - 11,000 sq. ft.  
Type - 60 mil HDPE  
Date - September 1993  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Private Estate  
Location - Malvern, PA  
Descrip. - Decorative Pond  
Area - 2500 sq. ft.  
Type - 30 mil Ultra-Tech  
Date - October 1993  
Seamer - R. Halbom

Owner - Nores Garage  
Location - Lewistown, PA  
Descrip. - Waste Oil Sump  
Area - 150 sq. Ft.  
Type - 60 mil HDPE  
Date - October 1993  
Seamer - M. Ramsden

Owner - Lukens Steel  
Location - Coatsville, PA  
Descrip. - Sump Underliner  
Area - 500 sq. ft.  
Type - 60 mil HDPE  
Date - November 1993  
Seamer - M. Ramsden

Owner - Abington Hospital  
Location - Abington, PA  
Descrip. - Wastewater Holding Tank  
Area - 770 sq. ft.  
Type - 36 mil Hypalon  
Date - February 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Sun Oil Company  
Location - Marcus Hook, PA  
Descrip. - Chemical Tank Underliner  
Area - 300 sq. ft.  
Type - 80 mil HDPE  
Date - February 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Sun Oil Company  
Location - Marcus Hook, PA  
Descrip. - 4 Petroleum Storage Tank Underliners  
Area - 13,000 sq. ft.  
Type - 60 mil HDPE  
Date - April 1994  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Andritz Bauer Sprout  
Location - Muncy, PA  
Descrip. - Secondary containment foundation liner  
Area - 132,000 sq. ft.  
Type - 30 mil PPE  
Date - April 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - White Tail Golf Associates  
Location - Bath, PA  
Descrip. - 5 ponds, the "Front 9"  
Area - 184,500 sq. ft.  
Type - 30 mil PVC  
Date - June 1994  
Seamer - R. Halbom

Owner - PA DOT  
Location - Rt 79, New Castle County PA  
Descrip. - Wastewater Treatment Lagoons  
Area - 8750 sq. ft.  
Type - 30 mil PVC  
Date - July 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Sun Oil Company  
Location - Marcus Hook, PA  
Descrip. - Dike Liner  
Area - 49,500 sq. ft.  
Type - 40 mil HDPE, Textured  
Date - August 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Lehighton Water Department  
Location - Lehighton, PA  
Descrip. - Water tank underliner  
Area - 2,500 sq. ft.  
Type - EX30 Coex  
Date - August 1994  
QA - M. Ramsden

Owner - Rohm & Haas  
Location - Bristol, PA  
Descrip. - Secondary containment - chemical tanks  
Area - 4,125 sq. ft.  
Type - 60 mil HDPE  
Date - September 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - City of Trenton  
Location - Trenton, NJ  
Descrip. - Lining of Aqueducts  
Area - 20,203 sq. ft.  
Type - 36 mil Hypalon  
Date - October 1994  
Seamer - R. Halbom

Owner - Sun Oil  
Location - Phila., PA  
Descrip. - Tank liner  
Area - 10,000 sq. ft.  
Type - 80 mil HDPE  
Date - November 1994  
Seamer - R. Halbom  
QA - M. Ramsden

Owner - Cheltenham Township  
Location - Cheltenham, PA  
Descrip. - Pond liner  
Area - 17,312 sq.ft.  
Type - 30 mil PPE  
Date - November 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Wheelabrator  
Location - Frackville, PA  
Descrip. - Secondary containment - oil tank  
Area - 5,600 sq. ft.  
Type - 60 mil HDPE  
Date - December 1994  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - City of Philadelphia  
Location - Belmont Reservoir  
Descrip. - Reservoir Liner  
Area - 118,000 sq. ft.  
Type - 60 mil HDPE  
Date - October, December 1994  
QA - M. Ramsden

Owner - PECO  
Location - Coatsville, PA  
Descrip. - Foundation liner  
Area - 35,000 sq. ft.  
Type - 36 mil PPE  
Date - February 1995  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - U.S. Navy (Philadelphia Navy Base)  
Prime Contractor - Magnum, Inc. 650 Catherine Street, Warminster, PA 18974  
Contact - Bob Daniele Ph - 215-957-7886, contract amount \$40,203.00  
Location - Phila., PA  
Descrip. - Hazardous Waste Handling Facility, secondary containment  
Area - 13350 sq. ft.  
Type - 40 mil HDPE  
Date - November 1997  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Logan Twp. Authority - 609-467-1650 Joe Weber  
Contractor - C&T Assoc. 215-721-1000 Tim Sherry  
Location - Bridgeport, N.J.  
Descrip. - Sewage Lagoon  
Area - 74,840 sq. ft.  
Type - 45 mil PPE  
Date - Jan. 1997  
Seamer - M. Ramsden  
QA - B. Smith

Owner - Wood Mill Commons  
Location - Sinking Springs, PA  
Descrip. - Underground detention basin  
Area - 26,320 sq. ft.  
Type - 20 mil PVC  
Date - March 1997  
Seamer - M. Ramsden  
QA - B. Smith



Owner - Ephrata Regional Authority  
Location - Ephrata, PA  
Contractor - Walabax Construction 2930 Clymer Road, Telford, PA 18969  
Jim Howard 215-721-6446 Contract amount - \$8.676.00

Descrip. - Biofilters  
Area - 6,500 sq. ft.  
Type - 30 mil PVC  
Date - June 1997  
Seamer - M. Ramsden  
QA - B. Smith

Owner - Modern Landfill  
Location - York, PA  
Descrip. - Swale liner  
Area - 10,000 sq. ft.  
Type - 60 mil HDPE  
Date - May 1997  
Seamer - R. Bumm  
QA - B. Smith

Owner - Star Refinery  
Location - Delaware City, Delaware  
Descrip. - Flyash settling pond  
Area - 550,000 sq. ft. (total 1,100,000 sq.ft.)  
Type - one layer 36 mil Hypalon, one layer 45 mil Hypalon  
Date - June 1997  
Seamer - B. Smith, R. Halborn, M. Ramsden  
QA - C. Calabria

Owner - University of Pennsylvania  
Contractor - A.P. Construction, Amadeo 215-922-2323  
Location - Kennett Square, PA  
Descrip. - Treatment Lagoons  
Area - 198,788 sq. ft.  
Type - 36 mil PPE  
Date - June 1997  
Seamer - M. Ramsden  
QA - B. Smith

Owner - Mitch Huber  
Location - Willow Street, PA  
Descrip. - Pond  
Area - 85,000 sq. ft.  
Type - 40 mil PPE  
Date - July 1997  
Seamer - M. Ramsden  
QA - B. Smith

Owner - Inhalon  
Location - Bethlehem, PA  
Descrip. - Detention Basin  
Area - 100,150 sq. ft.  
Type - 36 mil PPE  
Date - August 1997  
Seamer - M. Ramsden  
QA - R. Halbom

Owner - Pittsburgh International Airport  
Location - Pittsburgh, PA  
Descrip. - ARFF Fire training pit  
Area - 69,110 sq. ft.  
Type - 40 mil PPE  
Date - Oct. 1997  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Crompton & Knowles - Jim Ammend 610-582-6642  
Contractor - VFL Technology - 610-918-1100 Rob Roseborough  
Location - Gibraltar, PA  
Descrip. - Cap Impoundment  
Area - 154,000 sq. ft.  
Type - 36 mil PPE  
Date - Oct. 1997  
Seamer - B. Bumm, D. Huber  
QA - M. Ramsden

Owner - Brock Steel (contractor Carl Belt Co. \$23,900.00 contract)  
Location - Cumberland, MD (liner installation 100% by EGI)  
Descrip. - Containment system  
Area - 26,000 sq. ft.  
Type - 80 mil LHDPE  
Date - April 1998  
Seamer - Matt Hinkel  
QA - Richard Halbom

Owner - Cerragraphics  
Location - Hackensack, NJ  
Descrip. - Containment system  
Area - 40,000 sq.ft.  
Type - 45 mil PPE  
Date - Jan. 1998  
Seamer - Matt Hinkel  
QA - Richard Halbom

Owner - Occidental Chemical  
Contractor - Lewis Environmental, 77 Wells Road, Parkerford, PA 19457  
Steve Ohrwassel 610-495-6695 Contract amount - \$110,000.00  
Location - Pottstown, PA  
Descrip. - Landfill cap closure  
Area - 240,000 sq.ft.  
Type - 40 mil tex. PVC  
Date - June 1998  
Seamer - Mark Ramsden, Matt Hinkel  
QA - Richard Halbom

Owner - Revere Superfund Site  
Location - Revere, PA  
Descrip. - Landfill cap  
Area - 377,000 sq. ft.  
Type - 40 mil PVC  
Date - July 1998  
Seamer - Mark Ramsden/Matt Hinkel  
QA - Solmax

Owner - Specialty Mineral  
Contr. - Lehigh Valley Site Contractors, 5143 Lower Mud Run Rd., Easton, PA  
Royce Kark 610-515-9000 Contract amount - \$50,100.00  
Location - Easton, PA (engineer - ERM)  
Descrip. - Sludge impoundment  
Area - 27,000 sq. ft.  
Type - 40 mil HDPE  
Date - August 1998  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Pleasant Valley School District (GC-EGI, Engineer - Geosource)  
Location - Brodheadsville, PA (\$14,324.00 contract)  
Descrip. - Storage Lagoon  
Area - 18,000 sq. ft.  
Type - 60 mil HDPE  
Date - Sept. 1998  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Rohm & Haas  
Location - Bristol, PA  
Descrip. - Tank farm containment  
Area - 16,650 sq.ft.  
Type - 60 mil HDPE  
Date - January 1999  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Cypress Emerald  
Location - Waynesburg, PA  
Descrip. - Storage Lagoon - pond  
Area - 92,000 sq. ft.  
Type - 30 mil PPE  
Date - Jan. 1999  
Seamer - Matt Hinkel  
QA - Bill Burns

Owner - I.H.S.  
Contractor - Ruppert Environmental 301-924-7828 Jeff Schwartz  
Location - Sparks, Maryland  
Descrip. - Pond  
Area - 47,635 sq. ft.  
Type - 36 mil PPE  
Date - March 1999  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Riverfront Development  
Location - Wilmington, DE  
Descrip. - Bioswales  
Area - 136,000 sq. ft.  
Type - 40 mil PPE  
Date - April 1999  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Bally's A.C.C.C.  
Location - Atlantic City, N.J.  
Descrip. - Golf course irrigation pond  
Area - 73,000 sq. ft.  
Type - 30 mil PVC  
Date - May 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Mark Ramsden

Owner - ACME (building 264)  
Contractor - Handwerks Contractor, 2052 Lucon Rd., Skippack, PA 19479  
Ken Kibblehouse 610-495-6695 Contract amount \$30,059.00  
Location - Denver, PA  
Descrip. - Detention pond  
Area - 104,000 sq. ft.  
Type - 40 mil HDPE tex.  
Date - June 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Mark Ramsden

Owner - Lakeside Development  
Location - Middletown, DE  
Descrip. - Detention pond  
Area - 58,600 sq. ft.  
Type - 20 mil PVC  
Date - July 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Richard Halbom

Owner - Pittsburgh International Airport  
Contractor - JMD 5401 Progress Blvd., Bethel Park, PA 15102  
Denny Long 412-833-7100 Contract amount - \$10,670.00  
Location - Coraopolis, PA  
Descrip. - Fueling pad  
Area - 24,000 sq. ft.  
Type - 40 mil HDPE  
Date - August 1999  
Seamer - Matt Hinkel  
QA - Mark Ramsden

Owner - Merck & Co.  
Location - West Point, PA  
Contractor - Madison Construction, 130 Quaker Lane, Malvern, PA 19355  
Mr. Aldo Turzo 610-695-8800 Contract amount - \$47,560.00  
Descrip. - Fuel tank & unloading platform secondary containment  
Area - 51,560 sq. ft.  
Type - 40 mil HDPE  
Date - Sept. 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Mark Ramsden

Owner - Fairfield Place  
Location - Exton, PA  
Descrip. - Detention pond  
Area - 20,000 sq. ft.  
Type - 40 mil PVC  
Date - Oct. 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Mark Ramsden

Owner - Penn State (Thun Library) Berks campus  
Location - Sinking Springs, PA  
Descrip. - Pond  
Area - 30,000 sq. ft.  
Type - Bentofix GCL  
Date - Nov. 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Rick Halbom

Owner - Cumberland Cypress  
Location - Waynesburg, PA  
Descrip. - Tailings Pond  
Area - 88,000 sq. ft.  
Type - 30 mil PPE  
Date - Nov. 1999  
Seamer - Matt Hinkel, Darrell Huber  
QA - Bill Burns

Owner - Walmart  
Location - Trexlertown, PA  
Descrip. - Detention ponds, channels  
Area - 287,000 sq. ft.  
Type - 20 mil PPE  
Date - Jan. 2000 - July 2000  
Seamer - D. Huber, R. Griffin  
QA - R. Halbom

Owner - Leetsdale Industrial Park  
Location - Leetsdale, PA  
Descrip. - Stock pile containment area  
Area - 88,000 sq. ft.  
Type - 20 mil PPE  
Date - Feb. 2000  
Seamer - R. Griffin, Darrell Huber  
QA - R. Halbom

Owner - Tattersall Lane (Developer)  
Location - Upper Merion, PA  
Descrip. - Detention pondss  
Area - 10,000 sq. ft.  
Type - 40 mil PVC  
Date - March 2000  
Seamer - D. Huber, R. Griffin  
QA - R. Halbom

Owner - Franko Park - Salisbury Twp.  
Contactor - RGC Group, 610-837-3900 Robert Ciccone  
Location - Salibury, PA  
Descrip. - Pond  
Area - 33,068 sq. ft.  
Type - 45 mil PPE  
Date - April . 2000  
Seamer - R. Griffin, C. Whiting  
QA - M. Ramsden

Owner - PADOT  
Location - SR286, Rayne Twp., PA  
Descrip. - Membrane cap  
Area - 15,000 sq. ft.  
Type - 100 mil HDPE  
Date - April 2000  
Seamer - D. Huber, R. Griffin  
QA - R. Halbom

Owner - Target Stores  
Location - King of Prussia, PA  
Descrip. - Membrane barrier/ gas barrier  
Area - 155,105 sq. ft.  
Type - 20 mil PVC  
Date - May 2000  
Seamer - D. Huber, C. Matthews  
QA - R. Halbom



Owner - Target Stores  
Location - King of Prussia, PA  
Descrip. - Vapor barrier (rear of store)  
Area - 48,400 sq. ft.  
Type - 20 mil HDPE  
Date - May 2000  
Seamer - D. Huber, C. Matthews  
QA - R. Halbom

Owner - Longview Estates  
Location - Sinking Springs, PA  
Descrip. - Detention pond  
Area - 136,00 sq. ft.  
Type - 36 mil PPE  
Date - June 2000  
Seamer - R. Griffin, C. Whiting  
QA - M. Ramsden

Owner - Transit America  
Contractor - George E. Ley Co., 610-942-3809 Sumner Cross  
Location - Philadelphia, PA  
Descrip. - Golf Course ponds  
Area - 281,000 sq. ft.  
Type - 20 mil PPE  
Date - July 2000 - Nov. 2000  
Seamer - M. Ramsden, D. Huber  
QA - R. Halbom

Owner - Ben XL Co.  
Location - King of Prussia, PA  
Descrip. - Detention pond  
Area - 13,000 sq. ft.  
Type - 40 mil PVC  
Date - Aug. 2000  
Seamer - D. Huber, C. Matthews  
QA - M. Ramsden

Owner - 711 Asscolates  
Location - King of Prussia, PA  
Descrip. - Detention pond  
Area - 18,500 sq. ft.  
Type - 40 mil PVC  
Date - Sept. 2000  
Seamer - D. Huber, D. Nesslerode  
QA - M. Ramsden

Owner - Harding Landfill (IT Corp.)  
Location - Basking Rldge, PA  
Descrip. - Landfill Cap  
Area - 46,486 sq. ft.  
Type - 40 mil VFPE  
Date - Sept., 2000  
Seamer - D. Huber, D. Nesslerode  
QA - R. Halbom

Owner - Metzger Field, Lafayette College  
Location - Easton, PA  
Descrip. - Detention pond  
Area - 21,300 sq. ft.  
Type - 20 mil PVC  
Date - Oct. 2000  
Seamer - D. Huber, D. Nesslerode  
QA - M. Ramsden

Owner - Sun Oil  
Location - Sinking Springs, PA  
Descrip. - Ring wall liner  
Area - 34,000 sq. ft.  
Type - 60 mil HDPE  
Date - Nov. 2000  
Seamer - D. Huber, D. Nesslerode  
QA - R. Halbom



Established 1993

## WATERSAVER COMPANY, INC.

P.O. BOX 16465 3 DENVER, COLORADO 80216-0465

Phone: 303-256-1818 1-800-826-2424 Fax: 303-287-3138  
Plant and Office — 5870 E. 58th Avenue, Commerce City, Colorado 80022-2832  
[www.watersaver.com](http://www.watersaver.com)

-MEMO-

Date: 4/20/01

To: Mike Christie, Penn Environmental

From: Mark DeSandro,  
Watersaver Co, Inc.

REF: Liberty Property Trust

Dear Mike,

Please be advised that Environmental Geosynthetics, Inc. (EGI) is a Watersaver-approved installer.

Upon EGI's completion of the PVC liner installation, all manufacturer and fabricator warranties will apply.

Sincerely,

Mark Desandre  
WCI

WATERSAVER CO., INC.  
P.O. BOX 815  
LEMONT, PA 16851  
(814) 692-7599

cc: Rick Halbom, EGI

***APPENDIX B***

**WATERSAVER COMPANY, INC. INSTALLATION MANUAL AND  
SPECIFICATION SHEET FOR THE 40-MIL LINER**

# QUALITY STANDARDS

RECEIVED MAY 20 1996



MANUFACTURE, FABRICATION AND INSTALLATION  
OF  
POLYVINYL CHLORIDE GEOMEMBRANES  
(PVC)

JUNE, 1993

**WATERSAVER COMPANY, INC.**

P.O. Box 16465  
Denver, CO 80216-0465

(303) 289-1818

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# **1 GENERAL INFORMATION**

## **1.1 PURPOSE**

The purpose of this manual is to provide details of Manufacturing Quality Control (MQC), Manufacturing Quality Assurance (MQA), Construction Quality Control (CQC), and Construction Quality Assurance (CQA) for the manufacture, fabrication, and installation of PVC geomembrane products supplied by Watersaver Company, Inc.

## **1.2 CONFORMANCE WITH PROJECT SPECIFICATIONS**

It is the intent of Watersaver Company Inc. to comply with the generally recognized MQC, MQA, CQC and CQA standards and practices for governmental manufacturing, fabricating and installing industries. If required, modification to this manual can be made via addendum in order to accommodate individual job specific requirements.

# **2 GEOMEMBRANE MANUFACTURING**

## **2.1 RAW MATERIALS**

Watersaver Company Inc. requires all PVC manufacturers to certify that their PVC sheeting be formulated and manufactured from 100% virgin raw materials that are specifically compounded for use in hydraulic structures. Only first quality phthalate and/or phosphate plasticizers shall be used. The use of water soluble ingredients is prohibited. The compound must also contain a biocide at a viable formulation level.

The manufacturers are required to submit written certification that each lot of material meets or exceeds Watersaver Company's specifications as well as those published by NSF Standard 54-1991.

An example of Watersaver Company Inc.'s Engineering Specification Guide can be found in Appendix I.

An example of typical certified test results can be found in Appendix II.

## 2.2 ROLL GOODS

All roll goods received from Watersaver's PVC suppliers are visually inspected for imperfections and contaminants. In addition, selected physical property testing is conducted by Watersaver Company Inc. on each lot of PVC roll goods. Materials tested must meet or exceed the values specified by NSF Standard 54-1991. The following properties are evaluated:

<u>PROPERTY</u>	<u>TEST METHOD</u>
Thickness (inches, nominal)	ASTM D751
Breaking Factor (lbs/in)	ASTM D882
Elongation at Break (percent)	ASTM D882
Modulus @ 100% Elongation	ASTM D882

## 3 GEOMEMBRANE FABRICATION

### 3.1 FACTORY FABRICATION

Individual calendared widths of PVC are factory fabricated into large panels to minimize seaming during installation. Factory fabricated seams are a minimum one-half inch (1/2") width and extend to the edge of the sheet.

Factory seams are produced using either a chemical fusion agent, or by dielectric welding.

Factory fabrication production records identify each panel by panel number, size, date of fabrication, material lot number and seam station identification. Each panel is prominently marked with the panel number and panel size to coincide with production records.

### 3.2 IN-FACTORY SEAM TESTING

Visual and non-destructive inspection is performed on 100% of factory fabricated seams.

In addition, Watersaver Company Inc. performs destructive testing on factory fabricated seams in order to verify compliance with the values stated in section 3.3 of this document.

Samples of factory seams are taken at the beginning and at the end of each production shift. All seams are tested for compliance and the results are archived at Watersaver Company's facility.

An example of typical test results can be found in Appendix III.



### 3.3 FACTORY SEAM REQUIREMENTS

All factory seams meet or exceed the following requirements set forth by the National Sanitation Foundation Joint Committee on Flexible Membrane Liners - Standard 54-1991:

- A) Bonded Seam Strength  
Requirement: 80% of Specified Directional Sheet Strength  
Test Method: ASTM D882 as modified per NSF Standard 54.
  
- B) Peel Seam Strength  
Requirement: 10 Pounds Per Inch Minimum  
Test Method: ASTM D413 as modified per NSF Standard 54.

## 4 PACKAGING, HANDLING, AND TRANSPORTATION

### 4.1 PACKAGING AND HANDLING

After factory fabrication, the geomembrane panels are double accordion folded and packaged to minimize handling at the jobsite. Shipping cartons are water resistant, strong enough to prevent damage to the contents, and banded to heavy duty wood pallets. All cartons are identified by panel size, type, and number. Geomembrane panels which have been delivered to the jobsite are unloaded and stored in their original, unopened containers in a secure, dry area, and protected from weathering. Whenever possible, a 6-inch minimum air space between the cartons should be maintained, especially when the geomembrane panels are to be stored over an extended period of time. Pallets must not be stacked.

### 4.2 TRANSPORTATION

Transportation of the geomembrane will be arranged by Watersaver Company Inc. through an independent trucking firm, and will be shipped via a closed or flat bed trailer. Adequate tarps are recommended during transport.

Watersaver Company Inc. will be responsible for repairing or replacing any material damaged during shipment at no cost to the owner, however, the owner is responsible for noting and recording any damage at the time of delivery and immediately reporting same to Watersaver and the trucker.

## **5 INSTALLATION**

### **5.1 ANCHORAGE SYSTEM**

Unless otherwise specified, the anchor trench should be excavated by the Earthwork Contractor to the lines and grades shown on the design drawings. Store excavated material away from the area to be lined.

Complete trenching process prior to geomembrane placement.

A smooth transition surface from anchor trench to subgrade should be provided.

### **5.2 SUBGRADE**

#### **5.2.1 Preparation**

Surfaces to be lined will be free of all rocks, roots, vegetation, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the geomembrane with no sharp or abrupt changes in grade.

If an herbicide is required, it must be suitable for use with geomembranes and shall be applied as per the manufacturers recommendations. Suitability for use with the geomembrane shall be confirmed by the herbicide manufacturer.

#### **5.2.2 Repair and Maintenance**

Prior to geomembrane installation, the surfaces to be lined shall be inspected for acceptability by the installers. Any necessary repairs will be made by the owner or earthwork contractor. It is the responsibility of the owner or earthwork contractor to maintain the integrity of the subgrade prior to, and during the geomembrane installation. This includes the control of ground water in the area to be lined.

### **5.3 GEOMEMBRANE PANEL PLACEMENT**

#### **5.3.1 Panel Location**

Install the PVC geomembrane as indicated in the approved layout drawing. The installer may modify the proposed layout to best meet the intent of the project specification and/or to accommodate existing site conditions.

### 5.3.2 Weather Conditions

The PVC geomembrane panels shall be stored in their original packaging until ready for use. The geomembrane panels shall not be positioned when material temperatures are below 32°F. Panel deployment when material temperatures are below 32°F may require special handling and storage of the panels at a controlled temperature of at least 50°F. During low temperature installations, care must be taken to avoid "cold shock" impacting of the geomembrane.

### 5.3.3 Geomembrane Panel Deployment

The number of panels to be deployed in any day shall be limited to the number of panels which can be seamed or secured that day.

The geomembrane shall be installed in a relaxed manner and free of tension and stress. In areas where grade transitions occur, "bridging" or "trampolining" of the geomembrane shall not be allowed. To accommodate grade transition, adequate slack is necessary. Wrinkling of the geomembrane is acceptable and indicates proper slack consideration.

Deploy geomembrane panels to meet a minimum panel overlap of 6 inches.

Shingle all panels in the down gradient direction whenever possible.

### 5.3.4 Preparation for Seaming

Watersaver's approved installer shall verify the following:

- All personnel walking on the geomembrane liner shall have smooth soled shoes. Personnel working on the geomembrane shall not smoke and shall not engage in activities that could damage the geomembrane.
- Tools used in the installation process shall be properly stored and carried. Knives and other sharp objects shall be carried in protective sheaths.
- The method used to unfold panels shall not cause damage to the geomembrane or underlying geotextiles.
- Any geosynthetic elements directly underlying the geomembrane shall be clean and free of debris.
- Adequate temporary anchoring shall be placed to prevent wind uplift of the geomembrane panels. Typical items are sand bags and ballast tubes. In cases of high wind, continuous loading may be required along the edges of the geomembrane panel.
- High traffic areas may require temporary wear surfaces (i.e. geotextile, additional geomembrane, clean fill, etc.).
- Vehicles shall not be allowed on the geomembrane unless approved by the installer.

- Chemical fusion seaming agents, fuels and chemical cleaning agents shall be stored separately, away from PVC panels. Spill resistant containers shall be used while working directly on the geomembrane and shall be stored upon a sacrificial material such as scrap geomembrane or heavy cardboard.

## 5.4 FIELD SEAMING

### 5.4.1 Seam Preparation

The overlapped geomembrane panels must be clean at the surfaces to be joined. Any foreign material (e.g. dirt, moisture) must be removed with clean, dry rags before seaming commences.

If seaming must be conducted over rough substrate, seaming boards are recommended. A one foot by six foot pine shelf board will work well as a seaming platform.

### 5.4.2 Chemical Fusion Field Seaming

Chemical fusion agent shall be applied between the two surfaces to be joined. These surfaces shall be mated together, and pressure applied to the upper surface by means of a roller (high durometer rubber, nylon, or steel).

A sufficient amount of chemical fusion agent shall be applied between the two geomembrane surfaces to be joined such that when rolled, a thin excess of chemical fusion agent will be forced out of the seam. Any excess chemical fusion agent shall be wiped from the geomembrane. The lower of the two surfaces to be joined shall be completely wetted by the chemical fusion agent. Field seams shall be a minimum of 1 inch in width.

Fish mouths shall be slit, laid flat, bonded, then patched with a round or oval patch of the same geomembrane material. The patch shall extend a minimum of 6 inches beyond the repair area in all directions, and shall be seamed a minimum of 1 inch along its perimeter.

If any discontinuities are noted, allow the seaming agent to dissipate (approximately 1/2 hr) before re-applying agent. This process can be expedited by using artificial heat.

### 5.4.3 Cold Weather Chemical Fusion Field Seaming

Generally for cold weather seaming, when the geomembrane surface is below 40°F, the surfaces to be joined must be preheated.

If the soil beneath the geomembrane is frozen, the application of heat to the area to be seamed may result in condensation of moisture between the surfaces to be joined. This possibility may be eliminated by placing a seaming board, or slip sheet made from the same geomembrane material, between the wet surface and the geomembrane to be seamed.

#### 5.4.4 Pipe Penetrations

Penetrations are sealed via the use of Watersaver's factory fabricated pipe seals. Pipe seals are constructed of the same material and thickness as the specified geomembrane, and are bonded to the geomembrane via Watersaver's chemical fusion agent. The method of bonding shall be as outlined in section 5.4.2.

#### 5.5 BACKFILLING ANCHOR TRENCH

Following the completion of the seaming operation, the anchor trench shall be backfilled and compacted to lock in the geomembrane.

Care must be taken when backfilling trenches so as to prevent damage to the geomembrane. If damage occurs, the geomembrane installer shall make repairs before backfilling continues.

#### 5.6 LINING SYSTEM ACCEPTANCE

Watersaver's authorized installer shall retain responsibility for the geomembrane installation until acceptance by the Engineer and/or Owner.

The geomembrane liner installation will be accepted by the Owner when the following conditions have been met:

1. Installation of the geomembrane is complete.
2. Verification of the integrity of all seams and repairs, as required by the specifications, is complete.
3. All documentation pertaining to the geomembrane installation is completed and submitted to the Owner/Engineer.

### 6 FIELD QUALITY ASSURANCE

#### 6.1 OVERVIEW

Field seam quality shall be demonstrated by non-destructive (NDT) and destructive (DT) test methods.

The primary purpose of the NDT method is to demonstrate continuity along the entire length and to validate 100% of the field seam. NDT methodology is described in section 6.3 below.

The purpose of the DT method is to determine the quality of a given seam by removing a representative seam sample, and testing the given sample for compliance with accepted applicable industry standards. Testing may be conducted either at the job site, or at a remote testing laboratory. DT methodology is discussed in section 6.4 below.

## 6.2 TEST STRIPS/TRIAL SEAMS

A general requirement of most CQA Documents is that "test seams" or "test strips" be made on a periodic basis. Test strips generally reflect the quality of field seams but should never be used solely for the final field seam acceptance. Final field seam acceptance should be specified in the contract specification and should include a minimum level of destructive testing of the field seams. Test strips are made to minimize the amount of destructive sampling/testing which requires subsequent repair of the final field seam. Typically these test seams, for each seaming crew, are made once per day, or every time equipment is changed, or if significant changes in site conditions are noted, or as required in the contract specification. The purpose of these tests is to establish that proper seaming materials, temperatures, pressures, rates, and techniques along with the necessary geomembrane pre-seaming preparation is being accomplished. Test strips may be used for CQA/CQC evaluation, and must be of sufficient size in order to conduct required testing.

While cursory test seams are evaluated, the seaming crew may begin and continue to work as long as the field seam being constructed is completely traceable and identifiable. If a test seam fails to meet the field seam design specification, then an additional test seam sample is constructed and retested by the same seaming crew, equipment, and materials.

Field seams will not be accepted unless CQC seam test result criteria as per the design specification are met.

One of the following procedures shall apply whenever a sample fails a destructive test:

1. The field seam shall be reconstructed between two test locations shown to have acceptable results; one located on either side of the failed sample.
2. The seam shall be traced outward to intermediate points (a maximum of 10 feet from the failed sample in each direction) and sampled for additional testing. If the samples are found to provide acceptable test results, the seam is reconstructed between these two sample locations. If an intermediate sample fails, the process is repeated to establish the zone in which the seam is to be reconstructed. All reconstructed seams shall be defined by two locations from which samples passing other destructive tests have been taken.

Reconstruction of field seams shall be accomplished by either removing the suspect seam, repositioning panels and re-seaming, or by installing a cap strip to cover the seam under reconstruction. Cap stripping shall extend a minimum of six inches beyond the reconstructed seam in all directions.

For geomembrane seams that are bonded by the chemical fusion method, the seams must be cured prior to testing. Without the application of heat, the cure times can range from a few hours to a few days. Accelerated curing for on site CQC testing requires the use of an oven or other suitable heat source to condition the seam samples from 1 to 16 hours in a temperature range of 122°F to 158°F. Following the accelerated cure period, a post-cure conditioning period of at least 1/2 hour at ambient conditions prior to testing is required.

During the CQC and COA test requirement periods, a liner should not be covered and it cannot be placed into service. This will insure the ease of repairing or reconstructing in the event it is required. During this period, it is imperative that the liner be properly ballasted and otherwise secured so as to prevent wind or unusual weather damage.

## **6.3 NON-DESTRUCTIVE SEAM TESTING**

### **6.3.1 Air Lance Method**

All field seams shall be non-destructively tested over their full length. An air lance apparatus shall be used for this testing as described in Appendix IV of this document. The air lance shall be capable of supplying 80 psi through a 3/16 inch diameter nozzle. The air stream shall be directed at the edge of the seam no more than two inches from the seam edge. Enough time shall be allowed for the seams to develop adequate strength before commencement of testing. Any defects found during testing shall be marked, repaired, and retested with the air lance. All repairs shall be performed as described in section 6.3.2 (Remedial Action).

### **6.3.2 Remedial Action**

If unbonded areas are located, they can often be repaired by inserting additional chemical fusion agent into the seam opening, and then rolled. If this does not produce a satisfactory repair, then a patch consisting of the same geomembrane material must be installed over the repair area. The patch must extend a minimum of 6 inches beyond the area to be repaired.

## **6.4 DESTRUCTIVE SEAM TESTING**

### **6.4.1 Sampling Frequency**

Destructive seam testing can be conducted along completed field seams at intervals of 1000 feet (or at intervals indicated in the project specification, and as addressed by addendum to this document).

### **6.4.2 Sampling Procedure**

Samples shall be removed from the completed geomembrane seam by the installer. The sample shall be labeled in a clear and logical manner. The sample location must be identified and recorded.

Any holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired by patching the sampled area with identical geomembrane material. The patch must extend a minimum of six inches beyond the repair area in all directions. The continuity of repaired sampling locations shall be confirmed via NDT methods described above.

### 6.4.3 Sample Geometry

The *minimum* sample geometry shall be as follows:

Sample width shall be determined as the width of the field seam plus six inches on both sides of the seam.

Sample length shall be forty eight (48") inches.

See Appendix V for a diagram of the required sample.

### 6.4.4 Disposition of Samples

The sample described above shall be cut into three equal segments. One segment of the sample shall be submitted for laboratory (or field) testing; one segment to the installer, and the remaining segment to the owner.

### 6.4.5 Sample Preparation for Testing

#### 6.4.5.1 Conditioning

Conditioning of the samples prior to testing is imperative. Field seams produced using a chemical fusion agent must be allowed to cure until the required strength values can be achieved. Accelerated curing can be accomplished by conditioning the samples at temperature of 158°F for sixteen hours. Following the accelerated cure period, a post-cure conditioning period of at least 1/2 hour at ambient conditions prior to testing is required.

The samples shall be considered ready for testing when the chemical fusion agent odor is no longer detectable.

#### 6.4.5.2 Sampling

Test specimens shall be prepared as per Appendix VI from samples obtained per Section 6.4.3.

#### 6.4.5.3 Testing

Specimens shall be tested in order to determine bonded seam strength and peel adhesion. The testing shall proceed as described by ASTM D882 and ASTM D413 as modified by the National Sanitation Foundation Standard Number 54-1991.

### 6.4.6 Acceptance of Destructive Test Results

Destructive test results that demonstrate a minimum of 80% of the directional tensile/shear strength of the PVC material and a value of 10 lbs. per inch minimum peel strength shall be accepted as evidence of the liner's viability.



#### 6.4.7 Remedial Action - Destructive Test Failure

One of the following procedures shall apply whenever a sample fails a destructive test:

1. The field seam shall be reconstructed between two test locations shown to have acceptable results; one located on either side of the failed sample.
2. The seam shall be traced outward to intermediate points (a maximum of 10 feet from the failed sample in each direction) and sampled for additional testing. If the samples are found to provide acceptable test results, the seam is reconstructed between these two sample locations. If an intermediate sample fails, the process is repeated to establish the zone in which the seam is to be reconstructed. All reconstructed seams shall be defined by two locations from which samples passing other destructive tests have been taken.

Reconstruction of field seams shall be accomplished by either removing the suspect seam, repositioning panels and re-seaming, or by installing a cap strip to cover the seam under reconstruction. Cap stripping shall extend a minimum of six inches beyond the reconstructed seam in all directions.

#### 6.4.8 Verification of Repairs

Any Repair requiring a patch or cap strip shall be identified on the as-built drawing. Each repair shall undergo non-destructive testing as described in section 6.3 above. Repairs which pass the NDT shall be taken as an indication of proper repair. Failed NDT's will result in reconstruction and re-testing of the repair area until a passing result is obtained.

# WATERSAVER PVC

## GEOMEMBRANE LINER ENGINEERING SPECIFICATION GUIDE

### POLYVINYL CHLORIDE (PVC)



Est. 1953

Property	Test Method	Specified Values				
Thickness mils (Nominal $\pm 5\%$ )	ASTM D-1593	20	30	40	50	60
Specific Gravity, min.	ASTM D 792	1.23	1.23	1.23	1.23	1.23
Tensile Strength, psi, min. (Breaking Factor, lbs./in. width, min.)	ASTM D 882	2300 46	2300 69	2300 92	2300 115	2300 138
Elongation, @ Break, % min.	ASTM D 882	325	350	400	450	450
Modulus @ 100% Elongation, psi, min. (lbs./in. width min.)	ASTM D 882	1000 (20.0)	1000 (30.0)	1000 (40.0)	1000 (50.0)	1000 (60.0)
Tear Resistance, lbs./in., min. (lbs., min.)	ASTM D 1004	300 (6.0)	300 (9.0)	300 (12.0)	300 (15.0)	250 (15.0)
Low Temperature, °F	ASTM D 1790	-15	-20	-25	-30	-30
Dimensional Stability, % change, max.	ASTM D 1204 (212°F, 15min.)	3.5	3.5	3.5	3.5	3.5
Water Extraction % loss, max.	ASTM D 3083	0.25	0.25	0.35	0.35	0.35
Volatility % loss, max.	ASTM D 1203	0.90	0.70	0.50	0.50	0.50
Resistance to Soil Burial % change, max.	ASTM D 3083					
Tensile Strength		-5	-5	-5	-5	-5
Elongation, @ Break		-20	-20	-20	-20	-20
Modulus @ 100% Elongation		+20	+20	+20	+20	+20
Hydrostatic Resistance, psi, min.	ASTM D 751	60	85	92	125	165
Factory Seam Requirements*						
Bonded Seam Strength (factory seam, breaking factor, lbs./in. width)	ASTM D 3083, Modified	36.8	55.2	74.0	92	110.4

\*Factory bonded seam strength is the responsibility of the fabricator.

*APPENDIX C*

**TNS's INSTALLATION GUIDLINE,  
QUALITY CONTROL PROGRAM AND  
SPECIFICATION SHEET FOR THE GEOTEXTILE MEMBRANE  
TO BE USED AS THE DRAINAGE LAYER**

# **TNS Advanced Technologies / SKAPS Industries**

## **INSTALLATION GUIDELINE** **Nonwoven Geotextile, Nets and Composite**

### **INSTALLATION**

#### **HEAT SEAMING:**

##### **Nonwoven-Separate or Laminated**

Nonwoven geotextiles can be joined together by using fusion-seaming methods. The minimum overlap for this type of welding is (4) inches. Prior to fusion seaming the geotextile together, the installer must demonstrate to the field engineer the ability to perform this type of installation method. Areas burned through that are damaged by fusion welding shall be properly repaired. Care should be taken during installation to prevent damage to the geotextile. Torn or punctured material shall be patched with sufficient overlap to prevent separation.

#### **SEWING PROCEDURE:**

##### **Nonwoven-Separate or Laminated**

Fabric layers should be placed on the ground (preferably firm ground) so that the edges to be sewn are parallel and overlapping. The sewing operation typically requires three men: a machine operator and a man on each side of the machine to aid in fabric throughout. The lead man should hold the fabric edges evenly together and feed the fabric into the sewing machine head or folder. The man behind the machine should hold tension on the fabric so the machine operator has a taut and straight edge to sew across. If the machine misses a stitch or runs off the fabric, terminate the seam by cutting and tying the thread. Begin a new seam approximately one foot behind the broken seam.

#### **OVERLAPPING:**

##### **Nonwoven-Separate or Laminated**

##### **SEPARATE**

Roll goods form of geotextile should be overlapped a minimum of 12". Care should be taken that rolls remain parallel to each other. Extreme care should be taken to assure that soil does not intrude into the composite structure thus clogging the drainage net.

## **Installation Guidelines**

**Page 2**

### **COMPOSITE LAMINATION**

Composite rolls will be overlapped a minimum of 4". Care should be taken to ensure that overlapped edges do not curl or fall back thus leaving the net exposed to possible soil intrusion.

### **DRAINAGE NET & GEOCOMPOSITE**

#### **INSTALLATION:**

Transnet should be installed by hand. Once the roll is delivered to the installation location via rubber-tired loader or other appropriate machinery, the rolls should be inspected for any damage from shipping or handling. Once the rolls are positioned, they should be unrolled by hand. For slope applications, the rolls should be rolled from top to bottom and hand tightened to remove any wrinkles. The transnet portion of adjacent rolls shall be overlapped 2 to 4 inches or butt the rolls together when transnet is placed in flow direction. When placement of transnet is across flow direction or end-to-end seams, overlap in shingle placement fashion a minimum of 2 to 4 inches.

For end to end placement, the top layer of geotextile shall be peeled back and excess transnet will be trimmed so that the top layer of geotextile cover the attachment of two layers of geocomposite. The transnet will be attached to adjacent rolls utilizing plastic wire ties. The ties will be placed at a maximum spacing of 5 feet along the sides of the rolls and a maximum of 2 feet for end-to-end attachment. Metal ties or hog rings are not to be used.

## GEOTEXTILES

# TNS

### ADVANCED TECHNOLOGIES

681 DeYoung Road

Greer, South Carolina 29651

Phone: (800) 867-5181

Fax: (864) 879-4639

### Geotextile Product Description Sheet

#### Style TNS R120

TNS R120 is a superior quality, nonwoven geotextile produced by needlepunching together 100% polypropylene staple fibers in a random network to form a high strength dimensionally stable fabric. The polypropylene fibers are specially formulated to resist ultraviolet light deterioration, and are inert to commonly encountered soil chemicals. The fabric will not rot or mildew, is non-biodegradable, and is resistant to damage from insects and rodents. Polypropylene is stable within a pH range of 2 to 13. TNS R120 conforms to the physical property values listed below:

Fabric Property	Test Method	Units	Minimum Average Roll Value
Weight (typical)	ASTM D 3776	oz/sq.yd.	12.0 (408 g/sm)
Grab Tensile	ASTM D 4632	lbs.	300 (1.33 kN)
Grab Elongation	ASTM D 4632	%	50
Trap Tear	ASTM D 4533	lbs.	115 (.51 kN)
Puncture	ASTM D 4833	lbs	180 (.80 kN)
Mullen Burst	ASTM D 3786	psi	600 (4134 kPa)
Permittivity*	ASTM D 4491	1/sec	1.0
Water Flow*	ASTM D 4491	gpm/sqft	75 (3054 l/min/sm)
AOS	ASTM D 4751	U.S. Sieve	100 (.150 mm)
UV Resistance after 500 hrs.	ASTM D 4355	% Strength Retained	70

Packaging	
Roll Dimensions-Feet (Meters)	12.5 x 360/15 x 300
Square Yards (Square Meters) Per Roll	500
Estimated Roll Weight-Lbs. (Kg)	320

\* At time of manufacturing, handling may change these properties.  
To the best of our knowledge, the information contained herein is accurate. However, TNS Advanced Technologies cannot anticipate all conditions under which TNS product information and our products, or the products of other manufacturers in combination with our products, may be used. We accept no responsibility for results obtained by the application of this information or the safety or suitability of our products either alone or in combination with other products. Final determination of the suitability of any information or material for the use contemplated, of its manner of use, and whether the suggested use infringes any patents is the sole responsibility of the user.



**QUALITY CONTROL**

**PROGRAM OUTLINE**

# TNS ADVANCED TECHNOLOGIES

## QUALITY CONTROL PROGRAM OUTLINE

### Raw Material Quality Control

All raw materials used in the manufacture of TNS Advanced Technologies' products are certified by the supplier to meet the most stringent production standards in the industry. Each truckload of fiber received is certified by the resin supplier's quality control manager to meet specifications set by TNS. Upon delivery and unloading to TNS, each bale is entered into the plant computer tracking system. All fiber releases to production can be tracked by supplier and individual bale number for up to one year after the fiber is processed.

### Definition of Lot:

A planned production quantity satisfying all of the following:

- Manufactured under the same material specification
- Identified as the same style (fabric designation)
- When tested, having physical characteristics consistent with published values.

### Quality Control Sampling of Each Lot:

As a minimum, a number of production units shall be selected at random from each lot in accordance with Table 1.

TABLE 1 Number of Units to be Selected as Lot Sample  
Specification Conformance

<u>Number of Units in Lot</u>	<u>Number of Units Selected</u>
1 to 2	1
3 to 8	2
9 to 27	3
28 to 64	4
65 to 125	5
126 to 216	6
217 to 343	7
344 to 512	8
513 to 729	9
730 to 1000	10
1001 to more	11

Note: A production unit is considered to be a shipment roll.



Typically, the first shipment roll from each line will be sampled. It will be necessary to consider the minimum planned production quantity to determine if more frequent sampling and testing is required.

**Quality Control Testing of Each Sample:**

Each quality control sample shall be sent to the quality control lab before the end of the shift during which the sample was taken. Full identification of the sampled roll will be provided with the sample.

The following tests shall be run on every sample received in the Q. C. lab.

Test Property	Test Method
Weight	ASTM D 5261
Thickness	ASTM D 1777
Grab Tensile	ASTM D 4632
Grab Elongation	ASTM D 4632
Trapezoid Tear Strength	ASTM D 4533
Puncture Resistance	ASTM D 4833
Mullen Burst Strength	ASTM D 3786
Water Flow Rate	ASTM D 4491
Permeability	ASTM D 4491
Permittivity	ASTM D 4491
U.V. Resistance	ASTM D 4355
Apparent Opening Size (A.O.S.)	ASTM D 4751

**Quality Control Test Results:**

All quality control test results shall be maintained by the Quality Control manager with the corresponding shipment roll identification.

The Quality Control manager will make lot testing summaries available, upon request, detailing the individual test results and aggregate mean, minimum and standard deviations of each test property for the shipment rolls under consideration.

### **Certifications**

All certifications must originate with the quality control manager and / or the sales manager and be fully supported by available test data.

Two types of certifications shall be provided.

- Type 1:       Certifications of compliance with published physical property values. This certification can be provided as a blanket certification for all material satisfying TNS control requirements.
- Type 2:       Certification of compliance with specifications. This certification can be provided with material ordered to meet a set of specifications (including MARV's, which are provided with the order). No order containing specification requirements shall be confirmed until direction is received from the quality control manager indicating that specific shipment rolls meeting the specifications are available. Only those shipment rolls identified by the quality control manager shall be used to fulfill the order.

### **Packaging and Shipments:**

All geotextile rolls are wrapped for protection against moisture and extended ultraviolet exposure prior to placement. Each roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Rolls shall be stored in a manner which protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover.

### **Quality Control Procedures for Outsourced Products:**

The quality control procedures for outsourced products purchased by TNS Advanced Technologies will meet or exceed all quality control procedures previously listed. Each shipment of outsourced products received by TNS will be certified by the supplier's quality control manager and verified by the TNS quality control manager.

### **Failing Test Results:**

Individual test results failing below published minimums do not of themselves define failing production. First, duplicate tests should be run on the material in question to determine if the problem is in the test procedure. If the retest shows similarly failing results, then the Quality Control manager shall require an additional sample from an associated roll. If this additional testing shows similarly failing results, then all material from associated rolls will be given a different, unique style number (i.e. downgraded).

If the additional testing produces satisfactory test results, then the additional test results will be averaged with the initial test results and used as representative of the material produced. If the averaged test results fall below published limits, then all material from all associated roll will be downgraded.

### **Minimum Average Roll Values (MARV):**

Industry has coined the term MARV to reflect a 95% confidence level. To the manufacturer this means that 97.5% of all material produced should exceed a given MARV. Statistically, this is equivalent to the mean,  $\bar{x}$ , less two standard deviations.

As a result, it is only possible to confidently certify a MARV specification after referring to the actual test results for the shipment rolls to be provided (and others produced in the same time frame).

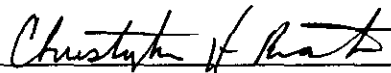
**APPENDIX D**

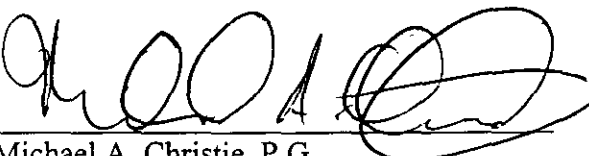
**SITE-SPECIFIC HEALTH & SAFETY PLAN**

**Site-Specific Health & Safety Plan  
For  
The Work Being Completed at Quarry No. 4  
At  
Liberty Property Trust's  
2201/2301 Renaissance Boulevard Properties  
Upper Merion Township, Montgomery County, PA**

**Prepared By:**

**Penn Environmental & Remediation, Inc.  
2755 Bergey Road  
Hatfield, PA 19440**

  
\_\_\_\_\_  
Christopher H. Branton, CIH  
Manager, Regulatory Affairs

  
\_\_\_\_\_  
Michael A. Christie, P.G.  
Vice President

February 2, 2001 (Original)  
April 20, 2001 (Revised)

## 1.0 GENERAL INFORMATION

Corporate Health & Safety Officer: Christopher Branton, CIH  
Office Number (215) 997-9000  
Address: Penn E&R, Inc.  
2755 Bergey Road  
Hatfield, PA 19440

On-Site Safety Coordinator: Thomas R. Christie  
Office Number (215) 997-9000  
Field Cellular Number (267) 246-1897  
Address: Penn E&R, Inc.  
2755 Bergey Road  
Hatfield, PA 19440

General Contractor: Steve Walton  
Office Number (610) 431-3500  
Field Cellular Number (484) 883-4725  
Address: The Norwood Company  
530 Brandywine Parkway  
West Chester, PA 19380

Primary Contractor: Mr. Paul Martino  
Office Number (610) 584-6020  
Address: Allan A. Myers  
P.O. Box 98  
Worcester, PA 19490

Site Name: LPT – 2201 and 2301 Property

Site Address: City Upper Merion Township  
County Montgomery  
State: Pennsylvania

Site Contact: Steve Walton Phone: (484) 883-4725

### SCOPE OF WORK:

Liberty Property Trust (LPT) is in the process of developing an office complex on adjoining properties located at 2201 and 2301 Renaissance Boulevard in Upper Merion Township, Montgomery County, PA. As shown on Figure 1, there is a former sand and gravel quarry which was historically filled located in the southeast corner of the 2201 Renaissance property. This quarry is known locally as Quarry No. 4.

As discussed below in detail, as part of the assessment of the materials that were used to fill this quarry, twenty-two soil samples have been collected from the quarry at various depths. Of the twenty-two samples, eight consisted of surface soils (i.e., soils from 0 to 2 feet below the ground surface) and fourteen consisted of subsurface soils (i.e., soils below a depth of 2 feet). Each of the samples was analyzed for the Target Compound List (TCL) volatile and semivolatile organic compounds and the Target Analyte List (TAL) inorganics (i.e., metals and cyanide). Also, eighteen of the samples were analyzed for the TCL pesticides and PCBs.

No compounds of concern were detected above their non-residential direct contact Medium Specific Concentrations (MSC) developed pursuant to Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2) in the eight surface soil samples collected from the quarry. Also, with the exception of lead in one sample, no compounds of concern were detected above their Act 2 non-residential direct contact MSC in the fourteen subsurface soil samples. Lead was detected at a concentration of 2,210 milligrams per kilogram (mg/kg) in one of the subsurface samples, which exceeds its Act 2 MSC of 1,000 mg/kg. However, the average lead concentration of 259 mg/kg for all samples collected from Quarry No. 4 is well below its Act 2 direct contact MSC.

As part of the on-site construction activities, limited grading of the surface and excavation into Quarry No. 4 has been or will be completed, and the quarry will be covered with clean soil. In preparation for these construction activities, Penn E&R completed a site-specific risk assessment to determine if lead levels in the soil in the quarry would present an unacceptable risk to on-site construction workers. Based on this assessment, the level of lead in the materials in the quarry will not result in any adverse health effects to on-site construction workers completing the planned soils work on the quarry.

This site-specific health and safety plan outlines the procedures for work within the limits of Quarry No. 4.

## **BACKGROUND INFORMATION:**

### **History of Quarry No. 4**

Existing information suggests that Quarry No. 4 was mined for sand and gravel from sometime in the 1800s until the early 1900s. Based on a review of historical aerial photographs, the quarry was inactive and filled with water between at least 1945 and 1959.

A 1965 aerial photograph shows that Quarry No. 4 was being filled at that time with what appears to be earthen material. Some water may still have been present in the center of the quarry at this time. Between 1965 and 1975, it appears that the quarry was being actively filled with earthen material. By 1980, the quarry appears to have been filled to grade. The 1980 photograph shows that there is vegetation present on the surface of the quarry and there are also dirt access roads present in the central portion of the quarry and along its southeast end. There appears to have been some minor filling/grading taking place on the surface of the quarry in 1985. No activities were evident on the quarry in 1990 or 1995 aerial photographs. By 1995, the

surface of the quarry was covered with vegetation. Based on the above, it appears that fill materials have been in place in the quarry for approximately 35 years.

#### **Results of Soil Samples Obtained from Quarry No. 4**

There have been three investigations of the contents of Quarry No. 4 since the early 1990s. The first investigation was performed in 1993 by Pennoni Associates, Inc. (Pennoni). As part of this investigation, Pennoni installed four soil borings in the quarry. These borings were designated PB-1, and PB-3 through PB-5. Boring PB-1 was completed at a depth of 32 feet below the ground surface (BGS), boring PB-3 was completed at a depth of 52 feet BGS, boring PB-4 was completed at a depth of 72 feet BGS, and boring PB-5 was completed at a depth of 52 feet BGS. The approximate locations at which these borings were installed are shown on Figure 1 in Appendix A. The borings were installed using a hollow-stem auger drilling rig. To evaluate the materials within and immediately below the quarry, Pennoni selected and submitted four samples for laboratory analysis. The samples selected for analysis were collected as follows: 1) from 27 to 29 feet BGS in boring PB-1; 2) from 10 to 12 feet BGS in boring PB-3; 3) from 35 to 37 feet BGS in boring PB-4; and 4) from 50 to 52 feet BGS in boring PB-5. The four samples were analyzed for the TCL organics (i.e., volatile and semi-volatile organic compounds and pesticides/PCBs) and the TAL inorganics (i.e., metals and cyanide).

As part of a Remedial Investigation/Feasibility Study (RI/FS) of the Crater site, which was implemented between 1996 and 1999, six additional soil samples were collected from Quarry No. 4. These samples were designated Q4-1 (0 to 0.5 feet BGS), Q4-2 (0 to 0.5 feet BGS), Q4-B-1 (18 to 20 feet BGS), Q4-B-1 (78 to 80 feet BGS), Q4-B-2 (6 to 8 feet BGS), and Q4-B-2 (40 to 42 feet BGS) and were collected from the approximate locations shown on Figure 1 in Appendix A. Soil samples Q4-1 and Q4-2 were collected directly from the surface of the quarry with the remaining four samples collected at depth from two soil borings designated Q4-B1 and Q4-B2. The six soil samples collected as part of the RI/FS were analyzed for the TCL organics (i.e., volatile and semivolatile organic compounds and pesticides/PCBs) and the TAL inorganics (i.e., metals and cyanide).

In 1998, Penn E&R was retained by LPT to complete a further investigation of Quarry No. 4. As part of this investigation, Penn E&R installed eight test trenches and two soil borings in the quarry. The test trenches were designated T-1 through T-8 and the borings SB-1 and SB-2. The test trenches were generally excavated to a depth of 15 feet BGS and borings SB-1 and SB-2 were completed at depths of 69 feet and 82 feet BGS, respectively. These test trenches and borings were installed at the approximate locations shown on Figure 1 in Appendix A. To evaluate the quality of the contents of the quarry, Penn E&R submitted twelve soil samples for laboratory analysis. These samples were designated SB-1 (14 to 16 feet BGS), SB-1 (55 to 57 feet BGS), SB-2 (10 to 12 feet BGS), SB-2 (42 to 44 feet BGS), Q4-T1 (2 feet BGS), Q4-T2 (2 feet BGS), Q4-T3 (2 feet BGS), Q4-T4 (2 feet BGS), Q4-T5 (2 feet BGS), Q4-T6 (15 feet BGS), Q4-T7 (13 feet BGS), and Q4-T8 (2 feet BGS). These twelve samples were analyzed for the TCL volatile and semivolatile organic compounds and the TAL inorganics. In addition, four of the samples (the SB designated samples) were also analyzed for pesticides and PCBs.



The results of the analysis of the twenty-two soil samples collected from Quarry No. 4 as part of the aforementioned investigations are summarized in Table 1 in Appendix B. In evaluating the soil sample analytical data, the results were compared to Act 2 non-residential, direct contact MSCs for surface soils. A discussion of the results of the analysis of these soil samples is provided below.

### **Volatile Organic Compounds**

No volatile organic compounds were detected above their Act 2 non-residential direct contact MSCs in the twenty-two soil samples collected from Quarry No. 4.

### **Semivolatile Organic Compounds**

No semivolatile organic compounds were detected above their Act 2 non-residential direct contact MSCs in the twenty-two soil samples collected from Quarry No. 4.

### **Pesticides/PCBs**

No pesticides or PCBs were detected above their Act 2 non-residential direct contact MSCs in the soil samples obtained from Quarry No. 4.

### **Inorganics**

#### Metals

With the exception of lead, no metals were detected above their Act 2 non-residential direct contact MSCs in the twenty-two soil samples collected from Quarry No. 4. Only one of the twenty-two samples collected from Quarry No. 4 exhibited lead above its Act 2 non-residential direct contact MSC of 1,000 mg/kg. Moreover, the average lead concentration for samples obtained from Quarry No. 4 of 259 mg/kg is well below its Act 2 non-residential direct contact MSC of 1,000 mg/kg.

#### Cyanide (total)

Cyanide was not detected above its Act 2 non-residential direct contact MSC in the twenty-two soil samples obtained from Quarry No. 4.

### **CHEMICAL EXPOSURE:**

As indicated above, only one of the twenty-two soil samples collected from Quarry No. 4 exhibited a contaminant above an Act 2 non-residential direct contact MSC. Lead was detected at 2,210 mg/kg in a sample collected from 14 to 16 feet BGS in boring SB-1 (see Figure 1 and Table 1). No other samples displayed lead above its Act 2 non-residential direct contact MSC. Also, none of the eight soil samples collected from the surface of the quarry exhibited any compounds of concern above Act 2 non-residential direct contact MSCs. Based on these

results, surface soils on Quarry No. 4 will not present an unacceptable risk to construction workers grading or placing soil on the surface of the quarry.

Although the average lead level for all the samples collected from Quarry No. 4 of 259 mg/kg is well below its Act 2 non-residential direct contact MSC of 1,000 mg/kg, one subsurface soil sample displayed lead at 2,210 mg/kg. Therefore, to ensure that lead levels in the subsurface soils in Quarry No. 4 do not present an unacceptable risk to on-site construction workers, Penn E&R conducted a focused risk assessment assuming a worst case scenario. That is, Penn E&R assumed that lead was present in the subsurface soils in Quarry No. 4 at a concentration of 2,210 mg/kg. In evaluating the possible worst case scenario, Penn E&R made the following conservative assumptions:

1. Employees would not be exposed to dust concentrations above the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 10 mg/m<sup>3</sup> of total dust while on site. Under normal excavating and construction operations, this limit is very rarely exceeded for short periods of time, and almost never exceeded for an entire 8-hour period. In addition, a dust concentration of 10 mg/m<sup>3</sup> would create a significant dust cloud over the entire site. Construction activities being completed at the Site, both within and outside the limits of the quarry, must ensure that this TLV for dust is not exceeded.
2. All of the dust that becomes airborne is assumed to be respirable. This is highly unlikely given that some portion of the dust generated will be too large to inhale.
3. All of the dust generated while working in the quarry would contain the highest possible concentration of lead found in the twenty two soil samples collected from the quarry (2,210 mg/kg). Again, this is highly unlikely given that the average concentration for lead in the soils in the quarry was determined to be 259.33 mg/kg.

Using these worst case assumptions, the highest concentration of airborne lead that personnel could be exposed while working within the limits of the quarry would be 22.1 ug/m<sup>3</sup>. This was calculated as follows:

$$\frac{10 \text{ mg soil dust}}{\text{m}^3} \times \frac{1000 \text{ ug}}{\text{mg}} \times \frac{2210 \text{ mg lead}}{\text{kg soil dust}} \times \frac{1 \text{ kg}}{1,000,000 \text{ mg}} = \frac{22.1 \text{ ug lead}}{\text{m}^3}$$

$$(\text{TLV} \times \text{Conversion} \times \text{Pb Concentration} \times \text{Conversion} = \text{Concentration})$$

This calculated airborne lead level of 22.1 ug/m<sup>3</sup>, which was developed based on a worst case scenario, is below the OSHA action level of 30 ug/m<sup>3</sup>. Therefore, no adverse exposure to on-site construction workers working in the quarry is expected. Also, a more reasonable assessment using the average lead level of 259.33 mg/kg, results in an airborne lead level of 2.59 ug/m<sup>3</sup>, which is well below OSHA's action level of 30 ug/m<sup>3</sup>.

Based on the information provided above, and our analysis of the soil samples collected from Quarry No. 4, the level of lead in the materials in the quarry would not result in any adverse health effects to on-site worker's completing the planned soil grading/excavation and covering of Quarry No. 4.

In order to ensure that the planned activities do not generate dust in excess of the TLV the following measures were implemented. Additionally, Penn E&R's Site Safety Coordinator will conduct periodic monitoring of all on-site activities. If a sustained visible dust cloud becomes apparent then work will be stopped and appropriate dust control measures will be implemented.

## **GENERAL SAFETY PRECAUTIONS:**

### **Preconstruction Meeting:**

Prior to excavating into Quarry No. 4, Penn E&R met on-site with representatives of LPT's general contractor who was responsible for overseeing all on-site construction activities. We presented to and discussed with Norwood the sampling activities that had been completed in Quarry No. 4. The results of the sampling were relayed to Norwood in a memorandum dated July 27, 1999 and through a letter sent to LPT dated August 5, 1999. The letter to LPT evaluated potential risks to on-site construction worker's and concluded that, even assuming the worst case scenario (i.e., lead was present in the soils in Quarry No. 4 at a maximum concentration of 2,210 mg/kg), the level of lead in the materials in the quarry would not result in any adverse health effects. The letter to LPT recommended that Norwood ensure that the TLV for dust at the site of 10 mg/m<sup>3</sup> was being met.

### **Site Inspections:**

As part of previous and the on-going construction activities, Penn E&R makes periodic site visits to evaluate the on-site construction activities. The primary objective of these site visits is to ensure that dust emissions are being properly controlled. If at any time a sustained visible dust cloud becomes apparent then work will be stopped and appropriate dust control measures will be implemented.

As indicated earlier, the primary construction activities planned for Quarry No. 4 include the grading of the surface of the Quarry and then the covering of the quarry with clean soil. As indicated above, no contaminants of concern were detected above Act 2 non-residential direct contact MSCs in the surface soils on the quarry. Therefore, these activities, which constitute a majority of the construction activities planned for the quarry, will not present an unacceptable risk to on-site construction workers.

With the exception of the installation of a sanitary sewer line through a portion of the Quarry, very little, if any, excavation into the quarry will be required. During the installation of the sanitary sewer line, a Penn E&R OSHA-certified inspector was on-site to oversee all excavation activities and to ensure that dust levels were maintained at acceptable levels. As part of the installation of this sewer line, about 500 tons of soil was excavated from the quarry. As

indicated to Ms. Andrea Lord at the USEPA during a meeting on June 25, 1999, during which the construction plans for the 2201 property were presented and discussed, we indicated that any materials removed from the quarry would be transported off-site for disposal at a properly permitted facility. As such, this material was characterized and subsequently shipped off-site for disposal at Waste Management's Pottstown, PA landfill. As part of the characterization process, one composite sample of the excavated materials was collected. This sample was analyzed for, among other compounds, lead. No compounds of concern, including lead, were detected above their Act 2 non-residential direct contact MSCs in this sample. Lead was detected at a concentration of 71 mg/kg. At this concentration, the presence of lead in the excavated materials would not present at unacceptable risk to on-site construction workers, which is consistent with what previous sample results indicated.

**Personal Protective Equipment:** Hard hats and work boots will be worn on-site at all times. All dust generated during the excavations activities must be kept to a minimum.

**Housekeeping:** All work areas will be maintained in an orderly manner.

**Fire Protection:** All fuel for heavy equipment will be stored in appropriate containers.

**First Aid and Medical Attention:** Montgomery Hospital will provide emergency medical attention.

**Tools:** All tools and equipment must be in good working order and fully comply with all OSHA Safety Rules and Health Regulations for the construction industry. All equipment must be inspected on a daily basis to ensure that they meet these requirements.

**Heavy Equipment:** All heavy equipment will be inspected on a daily basis to ensure that it is in good working order. All equipment must be operated by qualified operators.

**Excavations:** All excavations must be in accordance with OSHA regulations. All excavations must be secured at the end of each day to prevent non-employees from falling into the excavation.

**Dust Suppression:** If any visual signs of dust are generated during excavation or grading activities in Quarry No. 4, work will be immediately stopped. Appropriate measures to eliminate visual dust emissions such as wetting the soils prior to excavation, will be implemented before on-site activities can again be initiated.

## 2.0 HAZARD SUMMARY

<u>Apparent Hazard</u>	<u>Type of Facility</u>	<u>Status of Facility</u>
Serious _____	Mfg. _____	Active <u>X</u>
Moderate _____	Dump _____	Inactive _____
Low <u>X</u>	Landfill _____	Unknown _____
None _____	Open _____	
Unknown _____	Warehouse _____	
	Gasoline Service Station _____	

Other Office Building Complex and Filled Quarry

<u>Waste Type (s)</u>	<u>Waste Characteristics</u>	<u>Type/Form of Hazard</u>
Gas _____	Toxic _____	Dust <u>X</u>
Liquid _____	Corrosive _____	Liquid _____
Sludge _____	Ignitable _____	Fumes _____
Solid <u>X</u>	Volatile _____	Vapors _____
Unknown _____	Radioactive _____	Contact _____
Other <u>Soil</u>	Reactive _____	Respiratory _____
	Unknown _____	Other _____
	Other <u>Low Levels of</u>	IDLH _____

Lead in Soils

### 3.0 PERSONAL PROTECTIVE EQUIPMENT

Level of Protection: A \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_ D X

#### Tasks to be Performed:

The primary construction activities planned for Quarry No. 4 include the grading of the surface of the Quarry and then the covering of the quarry with clean soil. As indicated above, no contaminants of concern were detected above Act 2 non-residential direct contact MSCs in the surface soils on the quarry. Therefore, these activities, which constitute a majority of the construction activities planned for the quarry, will not present an unacceptable risk to on-site construction workers. With the exception of the installation of a sanitary sewer line through a portion of the Quarry, very little, if any, excavation into the quarry will be required. As indicated earlier, an OSHA-certified inspector from Penn E&R monitored these excavation activities.

### 4.0 MONITORING /SURVEILLANCE EQUIPMENT

HNU/PID	_____	Metal Detector	_____
OVA/GC	_____	Explosimeter	_____
Drager Tubes	_____	O <sub>2</sub> Detector	_____
Tri-Tector	_____	Radiation Survey Meter	_____

Notes:

**In order to ensure that the planned construction activities on Quarry No. 4 do not generate dust in excess of the TLV, Penn E&R's Site Safety Coordinator will complete periodic site inspections. If dust is being generated above the TLV, work will be immediately stopped and appropriate dust control measures will be implemented.**

### 5.0 EMERGENCY PHONE NUMBERS

Local Emergency Phone Numbers	Location	Phone	Notified
Fire	Unknown	911	
Police	Unknown	911	
Ambulance	Unknown	911	
Hospital	Montgomery Hospital, 1301 Powell Street, Norristown		
	610-270-2000 (general) or 610-270-2060 (emergency)		

Chemical trauma capability? Yes

DIRECTIONS TO HOSPITAL (Map is attached as Appendix C).

Route Verified by Sean M. Gallagher

**Go out of the main entrance for the 2201 Property onto Horizon Drive. Follow Horizon Dr. to Church Street. Make a left onto Church Street and proceed to Henderson Road. Make a right onto Henderson Road and proceed to Rt. 202. Make a right onto Rt. 202 north towards Norristown. After crossing bridge into Norristown, proceed straight on Markley Street. At fourth traffic light, make a right onto Fornance Street. Proceed to next light and make a right onto Powell Street. The hospital is located at the intersection of Powell and Fornance Streets.**

Additional Emergency Phone Contacts

PECO	(800) 841-4141
Chemtrec	(800) 424-9300
TSCA Hotline	(800) 424-9065, (202) 544-1404
AT&F (explosives info.)	(800) 424-9555
National Response Center	(800) 424-8802
Pesticide Information Service	(800) 845-7633
RCRA Hotline	(800) 424-9346
CMA Chemical Referral Center	(800) 262-8200
National Poison Control Center	(800) 942-5956
U.S. DOT	(202) 366-0656 (Day Only)
PADEP	(610)-832-6000
U.S. EPA Hotline	(800) 424-9346

## 6.0 SAFETY EQUIPMENT CHECKLIST

(Check equipment needed)

### Personal Protection

<input type="checkbox"/>	Respirator
<input type="checkbox"/>	Cartridges
<input type="checkbox"/>	Type
<input checked="" type="checkbox"/>	Safety Boots
<input type="checkbox"/>	Rubber Boots
<input type="checkbox"/>	Coveralls (tyvek)
<input type="checkbox"/>	Coveralls (cotton)
<input checked="" type="checkbox"/>	Hard Hat
<input type="checkbox"/>	PVC Rain Gear
<input type="checkbox"/>	Safety Glasses
<input type="checkbox"/>	Nitrile/Latex Gloves
<input type="checkbox"/>	Viton Gloves
<input type="checkbox"/>	Disposable Booties
<input type="checkbox"/>	Disposable Gloves
<input checked="" type="checkbox"/>	Hearing Protection
	(when sound levels exceed 90 DBA)
<input type="checkbox"/>	SCBA
<input type="checkbox"/>	Cascade System

### Monitoring and Surveillance

<input type="checkbox"/>	Radiation
<input type="checkbox"/>	O <sub>2</sub>
<input type="checkbox"/>	OVA
<input type="checkbox"/>	Explosimeter
<input type="checkbox"/>	HNU
<input type="checkbox"/>	TLD Badges
<input type="checkbox"/>	Metal Detector

### Decon Equipment

<input type="checkbox"/>	Tub
<input type="checkbox"/>	Water
<input type="checkbox"/>	Garbage Can
<input type="checkbox"/>	w/ Liner
<input type="checkbox"/>	Bucket
<input type="checkbox"/>	Plastic Garbage
<input type="checkbox"/>	Bags
<input type="checkbox"/>	Detergent
<input type="checkbox"/>	Hand Soap

### Miscellaneous

First Aid Kit	<input checked="" type="checkbox"/>
Water	<input type="checkbox"/>
Fire Extinguisher	<input type="checkbox"/>

### Other (specify)

<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	



## **7.0 GENERAL SAFETY RULES AND REGULATIONS**

Safety of all employees and subcontractor personnel is our number one goal.

### **1. PERSONAL PROTECTIVE EQUIPMENT:**

- a. Hard hats must be worn at all times on the job.
- b. If required, safety glasses and/or applicable added face protection must be worn at all times on the job.
- c. The wearing of safety shoes is required. The wearing of canvas shoes, moccasins, loafers, house slippers, or any open-toed shoes on the job is prohibited.
- d. Approved hearing protection must be provided in posted high noise level areas.
- e. Approved respirators must be worn in areas of harmful dusts, gases, mists and vapors. (Consult Corporate Health and Safety Officer when in doubt).
- f. Safety belts, lanyards, lifelines and/or safety nets must be utilized in accordance with federal standards.
- g. Employees must be properly clothed for their work. Full-length trousers and long sleeve shirts are required in all areas.
- h. Hair length must conform to the safety requirements of the respective jobs and work areas.

### **2. HOUSEKEEPING:**

- a. All work areas, passageways and walkways must be maintained in an orderly manner.
- b. Waste of all kinds, including empty bottles, shall be placed in proper containers provided for same.
- c. Scrap lumber must be piled orderly and projecting nails must be pulled or bent over to eliminate a hazard.

3. FIRE PROTECTION AND PREVENTION:

- a. "NO SMOKING" must be observed throughout the job site except in designated areas.
- b. All combustible or flammable materials must be stored, dispensed and used properly.
- c. Adequate fire protection and prevention must be maintained on-site.

4. FIRST AID AND MEDICAL ATTENTION:

- a. First aid and medical attention will only be provided by persons with valid first aid training from the U.S. Bureau of Mines, the American Red Cross or equivalent training that can be verified by documentary evidence on the Site. In case of an emergency the local emergency service will be contacted to provide emergency medical attention.

5. HANDLING AND STORAGE OF MATERIALS:

- a. Materials must be stocked, racked, blocked, or otherwise secured to prevent sliding, falling, or collapse.
- b. Rigging equipment must be used properly and inspected.
- c. Safe working load must be marked clearly on all hoists, slings, chains, etc.

6. TOOLS (HAND, POWER - AND POWER-ACTUATE):

- a. All mechanical safeguards must be in use.
- b. All tools must be grounded properly or double insulated.
- c. All tools must be inspected and maintained properly including cords and wiring.
- d. All licensing laws and ordinances must be complied with.

7. ELECTRICAL:

- a. All electrical wiring and equipment must comply with NFPA, NEC and ANSI standards.
- b. All electrical wiring will be inspected daily to for any defects.

8. LADDERS AND SCAFFOLDS:

- a. All ladders and scaffolds (including ropes and cables) must be inspected regularly and maintained in good condition.
- b. Scaffolds must be provided with guard-rails, mid-rails, and toe-boards.
- c. Straight ladders must be provided with safety feet and properly secured to prevent slipping, falling or sliding.

9. FLOOR AND WALL OPENINGS AND STAIRWAYS:

- a. All must be guarded properly.
- b. All stairs or platforms having four or more risers must be guarded by standard stair rail.
- c. Open-sided platforms six feet above the ground or floor must be guarded.

10. CRANES, DERRICKS AND HEAVY EQUIPMENT:

- a. All equipment must be maintained properly and inspected including cables, sleeves, slings, chains, hooks, eyes and the posting of load capacities, hand signals, operating speeds, and special instructions.
- b. Where applicable, approved rollover protection must be provided for graders, dozers, fork lifts, scrapers, tractors, etc.
- c. Noise arresters and back-up alarms must be provided, and operational.

11. MOTOR VEHICLES:

- a. All motor vehicles must have qualified operators.
- b. All vehicles must be inspected and maintained regularly and weigh limits and load sizes controlled.

12. EXCAVATIONS - SHORING, TRENCHING AND FORMS:

- a. Ladders, barricades, shoring, forms, ramps, etc., must be in accordance with OSHA regulations.

13. SIGNS AND TAGS:

- a. Signs that warn of hazards must be visible and posted properly.
- b. Accident prevention tags must be used as a temporary means of warning employees of an existing hazard.

14. EXPLOSIVE BLASTING:

- a. State regulations must be observed.
- b. Prior approval must be obtained from the Safety and Industrial Hygiene Department and the appropriate Operating Superintendent.

15. FLAMMABLE GASES AND LIQUIDS:

- a. Proper storage practices must be maintained.
- b. Fire protection must meet all standards for storage areas.
- c. All containers and storage areas must be identified properly.

The following regulations must be complied with:

- 1. Permit for Cutting and Welding with Gas or Electric Equipment.
- 2. Permit for Entering Tank, Manhole, Pipeline, Pit, or Closed Vessel.
- 3. Railroad and Blue Flag Regulations.
- 4. Fire Boxes and Alarms.
- 5. Mobile Equipment Operating Rules.
- 6. Electrical Lockout Procedure.

## **8.0 CONSTRUCTION ACTIVITIES**

All portions of the surface of Quarry No. 4 that have been or are going to be disturbed by construction activities have been covered with several feet of clean soil. Therefore, on-site construction workers will not come in contact with materials in Quarry No. 4.

A portion of a stormwater detection basin being constructed on LPT's 2301 property will cover a small portion of the western end of Quarry No. 4. The construction of this basin, which will include the placement of clean soil over a portion of Quarry No. 4 to form the basin, will be completed from approximately April 23, 2001 to May 25, 2001.

No further intrusive work into the quarry is expected. If such is required, the On-Site Safety Coordinator will notify the EPA and will ensure that the requirements of this Health and Safety Plan are fully implemented.

## **9.0 CONTINGENCY PLAN**

Penn E&R's Health and Safety Coordinator will be on-site during all intrusive earth moving activities. If any signs of potential contamination are observed, work in that area will be immediately stopped and all workers removed from the area. The potential area of concern will then be secured with a temporary fence. The EPA Remedial Project Manager will be alerted to the presence of the potential area of concern. A plan to investigate the potential area of concern will then be developed and submitted to the EPA. Only OSHA-trained personnel will be allowed access to the area until appropriate investigations have been performed, a plan of action to remediate any contamination, if such is required, has been implemented, and clearance has been received from the EPA.

**Appendix A**

**Figure 1 Showing Soil Sample Locations**

**NOTE:**

(1) THE BOUNDARIES OF QUARRY NOS. 2, 3 & 4 ARE ONLY APPROXIMATE AND ARE BASED ON A REVIEW OF HISTORICAL AERIAL PHOTOGRAPHS

(2) THE SOIL BORINGS & TEST TRENCH LOCATIONS ARE APPROXIMATE.

**LEGEND**

- PB-4 Pennoni 1993 Soil Sample/Boring Location
- ★ Q4-1/Q4-B1 ERM 1996/1997 Soil Sample/Boring Location
- ▲ SB-1/T-7 Penn E&R, 1998 Test-Pit/Soil Sample Location

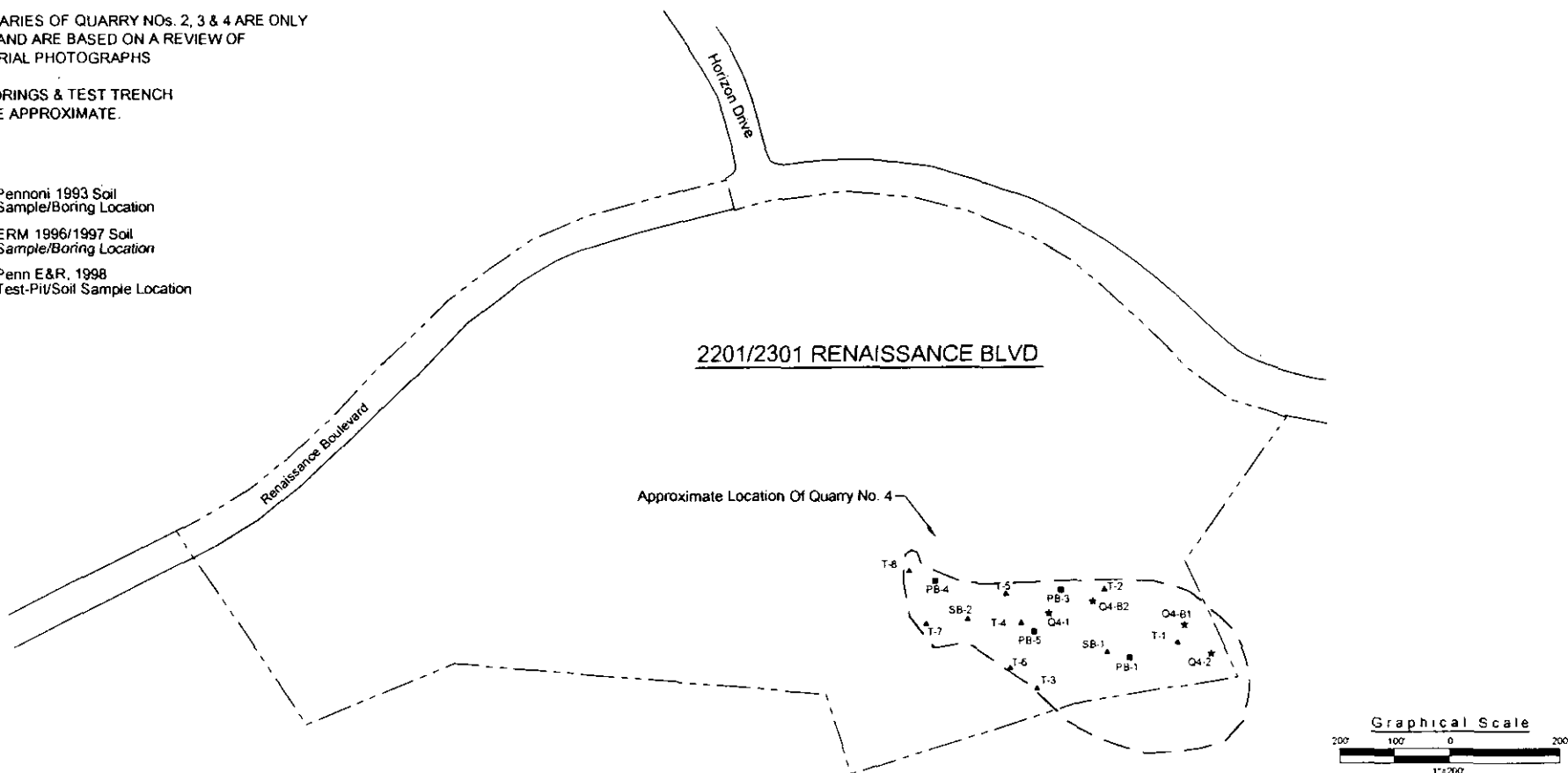


Figure 1

Site Map For 2201/2301  
Renaissance Blvd. Showing Limits of  
Quarry No. 4 and Soil Sample Locations

Renaissance Park  
Upper Merion Township  
Montgomery County, Pennsylvania

DRAWN BY	DATE	SCALE
SMD	10-Jan-01	1"=200'



**Penn E&R**  
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## **Appendix B**

### **Table 1 Summarizing Soil Sampling Conducted at the Site**

TABLE I  
SUMMARY OF ANALYTICAL RESULTS FOR  
SOIL SAMPLES COLLECTED BY QUARRY #4

[illegible]

5480

- 111 All results are unadjusted per kilogram  
112 *Polymeric Degradation of Environmental Protection, Land Saver and Environmental Remediation Standards Act (21,*  
113 *Canadian Council of Ministers of the Environment (1997).*  
114 Only those variables with a significant correlation and positive effect were included in the model based on the  
115 study data.  
116 The correct MSAC developed for humans is 90% confidence. The PADEP is a study of the air and its components to remove the  
117 maximum. The MSAC for humans was calculated using the correct mass element data.  
118 *Environment Canada, Department of Environmental Protection*  
119 *Non-Hazardous Dioxin Content*  
120 *Median Species Concentration*  
121 *Environmental Protection Department*  
122 *Environmental Protection Department*  
123 This result should be considered a quantitative estimate.  
124 *Environment Canada*  
125 The results in this study were based on the (unadjusted) results as they were obtained in a study in a similar environment.  
126 *Environment Canada*  
127 *Environment Canada*  
128 *Environment Canada*

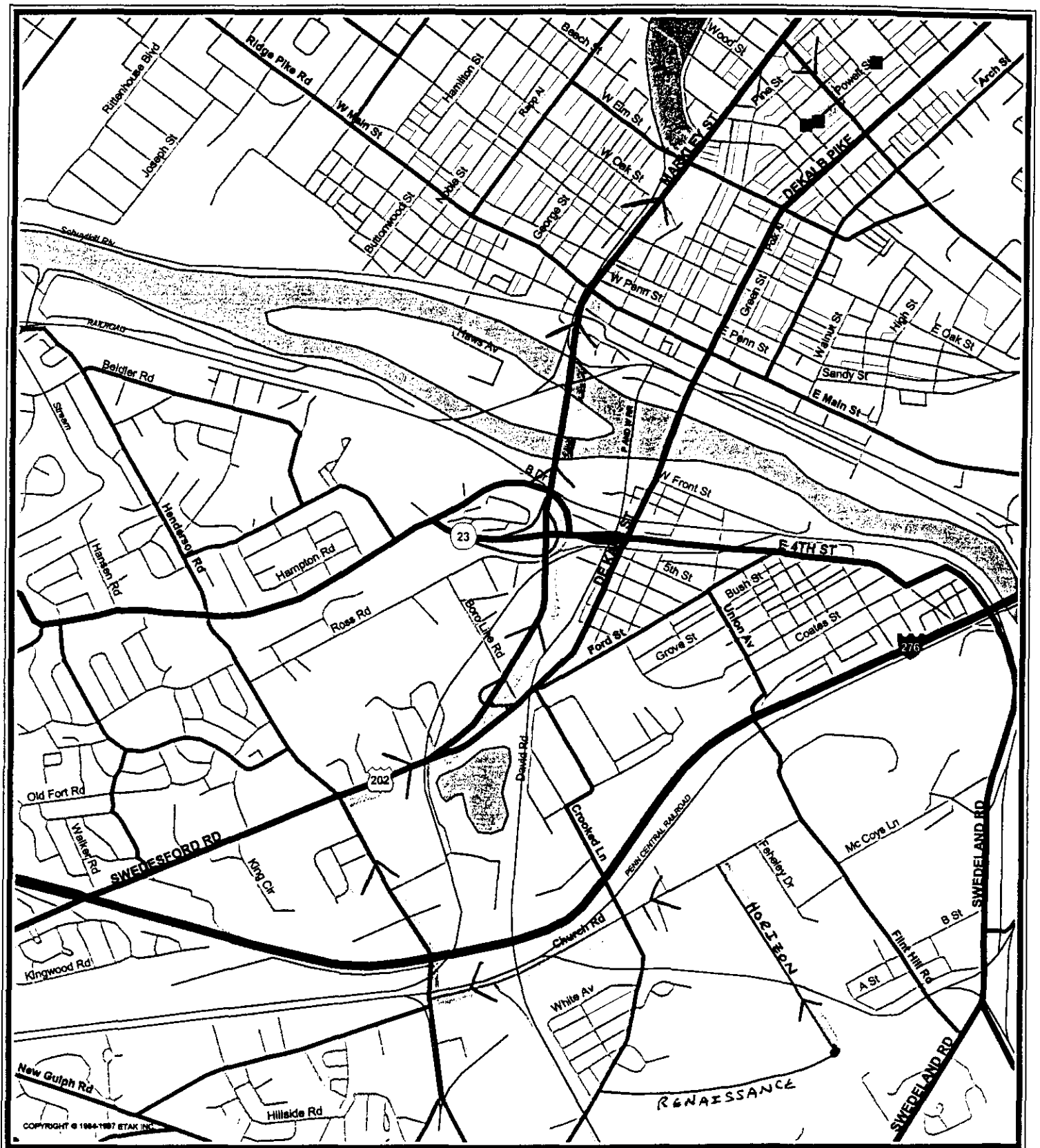
- |       |   |
|-------|---|
| L1    | The sample was detected. The numeric value represents the sample quantization level for this sample.  |
| L2    | The result should be considered a banded low quantization sample.   |
| L3    | The result should be considered a banded high quantization sample.  |
| NE1   | Not detected.   |
| +0 L2 | Compared was not detected above the masked initial value.   |
| NA1   | Not sampled.  |
| NA2   | No sample available.  |
| L5    | The sample was not detected. The numeric value that represents the quantization detection level for the sample is a greater value.                        |
| L6    | The sample was not sampled or not detected. The numeric value that represents the quantization level of the compared is a banded low quantization sample. |

**Build:** Computed was detected above as PADEP MSC

## **Appendix C**

### **Location Map Showing Hospital and Site**

# Current Map



## **Appendix D**

### **OSHA PELs for Manganese, Aluminum, Chromium, Iron and Vanadium**

Lead was selected as the highest hazard on-site based on concentrations known to be present and its permissible approved level (PEL), which is 50 ug/m3. The metals listed below, which were identified by EPA as possible constituents of concern, have significantly higher PELs than lead, as shown below:

Manganese	5,000 ug/m3
Aluminum	15,000 ug/m3
Chromium	1,000 ug/m3
Iron (oxide fume)	10,000 ug/m3
Vanadium (respirable and fume)	500 ug/m3
Lead	50 ug/m3

Chromium and vanadium were considered during the exposure assessment, as their respective PELs are 20 and 10 times higher than the lead PEL. However, the average and maximum concentrations of these two metals in Quarry No. 4 were less than average and maximum concentration for lead. Therefore, lead, the most toxic metal was used as a baseline, worst case scenario for this assessment. If potential exposure to lead posed no threat of overexposure, the aforementioned metals pose even less of a risk. In addition, lead is the only metal present in the soils within Quarry No. 4 that exceeded PADEP Act 2 non-residential direct contact Medium Specific Concentrations, which are risk based cleanup standards.